MINIMIZING THE HUMAN CAPITAL ASPECT OF PRODUCTIVITY DISRUPTION DURING IMPLEMENTATION OF AN ENTERPRISE RESOURCE PLANNING (ERP) SYSTEM

GRADUATE RESEARCH PROJECT

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Abstract

The Air Force is investing a great deal of time and money in development of the Expeditionary Combat Support System (ECSS), an Enterprise Resource Planning (ERP) system. When implemented, ECSS will completely transform the way the logistics community does business. It will reduce 400 plus legacy systems to just one enterprise wide system, as well as touch every process we operate and make major changes to most of these processes (Dunn, 2007). With any process change as large as ECSS, there will be a dip in productivity during implementation.

In order to minimize the productivity dip, it is necessary to have a realistic expectation regarding depth and duration of the dip, and understand the factors that contribute to the dip including how to manage them. The literature identifies what typical productivity changes look like over the duration of an implementation, but does not specifically address the factors that contribute to the dip. The intent of this study is to identify human capital factors that affect the dip. Then, using a multiple case study methodology, the study empirically tests how well the identified factors compare to what companies who implemented ERP systems actually experienced. Finally, this study identifies how companies can address human capital factors to minimize the dip.

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To my husband who made this effort possible and my children who endured my "homework" absences. I love you all very much.

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Julie S. Newlin

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I. Introduction

Background

The Air Force is investing a great deal of time and money in development of the Expeditionary Combat Support System (ECSS), an ERP system. When implemented, ECSS will completely transform the way the logistics community does business. It will reduce 400 plus legacy systems to just one enterprise wide system, as well as touch every process we operate and make major changes to most of these processes (Dunn, 2007).

In preparation for the stage one rollout projected for 2010, it is prudent to do everything possible to ensure a smooth transition. Ideally, implementation of ECSS would result in an increase in productivity immediately upon roll-out. However, research shows there will be a dip in productivity before it exceeds pre-implementation rates. Focus should not be on how to avoid a dip but on how to address contributing factors to keep the dip short and shallow. One factor that needs to be examined is human capital.

Research Question

How do you minimize the human capital aspect of productivity disruption during implementation of an Enterprise Resource Planning System (ERP)?

Research Objectives

The research objective was to identify productivity changes, including depth and duration of productivity dips, caused by implementation of extensive process changes and pinpoint the human capital factors that contribute to those dips. Additionally, this research identified actions taken by organizations during implementation to minimize or recover from dips. The goal was to address a gap in information available on the dip during ERP implementation and provide personnel charged with implementation of ECSS with this knowledge so that the productivity dip experienced by the Air Force is short and shallow.

Investigative Questions

Question #1: How do organizations track productivity?

Question #2: How deep and wide is the average productivity dip?

Question #3: How do organizations minimize the human capital aspect of a productivity dip?

Question #4: What human capital factors are most influential on the productivity dip?

Question #5: How much of the productivity dip is attributable to human capital factors?

Research Focus

The research focus was on identifying human factors that contribute to productivity dip when an ERP is implemented, and then how to overcome these factors. This was accomplished through a review of selected relevant literature and through interviews with organizations that had implemented an ERP and experienced the productivity dips first-hand.

Methodology/Theoretical Lens

The primary methodology used was the multiple case study. This method was chosen since the research question is to determine "how" and is qualitative in nature. How and why questions are more explanatory and likely to lead to the use of case studies (Yin, 2003).

Assumptions/Limitations

Assumption #1: Civilian organization experiences are generalizable to the military.

Assumption #2: An increase in output increases productivity.

Limitation #1: Research is limited to human capital factors that affect productivity.

Limitation #2: Productivity measures vary by organization and may be difficult to compare across cases.

Implications

The results of this research could be very useful for an organization pending implementation of an ERP. Recognizing the human capital issues it is likely to experience allows it to address these items before they become problems and ultimately, enables the organization to minimize productivity loss.

Summary

Productivity typically dips immediately following an organization's ERP system implementation. While it may not be possible to prevent this dip, it is worthwhile to address the depth and duration of it. There are many factors that could contribute to this initial dip, one of which is the human capital factor. Through a process of reviewing selected literature on ERP implementations and interviewing personnel from

organizations that have experienced the dip first hand, factors to focus on can be identified. By targeting these factors, organizations can keep the dip short and shallow.

Chapter one was simply an introduction and preview of the research. Chapter two reviews the literature relevant to the research question and identifies the gap that will be addressed. Chapter three explains the methodology used and details the steps taken in ensuring the research is rigorous. Chapter four details the data analysis and research findings while chapter five summarizes the findings and explains how they pertain to the Air Force implementation of ECSS.

II. Literature Review

Introduction

There is a great deal of information available on Enterprise Resource Planning (ERP) and productivity is a field all to itself. This literature review attempts to capture those thoughts and ideas most relevant to the research topic while not excluding any major schools of thought. The review starts with an overview of ERP, including the major critical success factors and life cycle models. Next, productivity as used in this study is defined and methods of measurement are explored. This is followed by expanding on the human capital factors that may contribute to or distract from ERP success. Finally, the Air Force version of ERP, Expeditionary Combat Support System (ECSS), is discussed.

Enterprise Resource Planning (ERP)

ERP systems are comprehensive packaged software solutions which aim for total integration of all business processes and functions (Pollock, Williams, & Procter, 2003). The definition from the Center for Digital Government is straightforward: “Business applications used by enterprises to manage and integrate best practice business, financial, administrative, and operational processes across multiple divisions and organizational boundaries. These applications act as the backbone of the enterprise and are designed to support and automate the processes of an organization” (2005). ERP systems are reshaping business structures because they promise to solve the challenges posed by portfolios of supposedly disconnected and uncoordinated business applications (Kumar, Maheshwari & Kumar, 2003).

Integrated enterprise-wide software solutions are part of the software market that is bound from below (closer to the computer) by the market for operating systems, programming tools, and utilities and from above (closer to the user) by end-user applications such as desktop productivity solutions and multimedia software (Pollock et al., 2003). Typically, "canned" software is taken and modified as necessary to fit the customer, sometimes called genericification and standardization. Genericification basically means taking a product that worked somewhere and making it generic, so that it also works in other similar situations. For example, the software package studied by Pollock et al., (2003), was initially conceived for and used by manufacturing firms before being applied within non-manufacturing settings (pharmaceuticals, chemicals, retail, banking, etc.) and then non-commercial contexts (health care, public sector, higher education and so on).

Today, ERP systems are so widely diffused that they are now commonly described as the *de facto* standard for replacement of legacy systems in medium and large-sized organizations, and it is said that some companies find it impossible to work without one (Pollock et al., 2003). Instead of designing the software for a company, it is designed for a market. It may not be the best solution for any one company, but will fit as a solution for many companies.

The reasons for implementing ERP range from being afraid of what would happen if they don't to wanting to maximize technology in operations. The CIO of a diversified electronics manufacturer that was 19 sites into a global enterprise resources planning rollout stated "Our goal is simple: to manage the business as a single globally integrated enterprise, not as a loose collection of independent businesses" (Wheatley, 2007). This

same thought has resulted in some of the world's largest corporations following suite. Coca-Cola, for example, has a single instance of SAP ERP that binds together 15,000 users in 45 countries—encompassing no fewer than 175 legal entities. Many of their bottlers are SAP users too, constituting a total network of more than 1,000 production plants, a delivery fleet five times larger than UPS and somewhere between $85 billion and $90 billion in annual revenues (Wheatley, 2007).

One study indicated that firms typically provide one of five reasons for implementing ERP, number one being the need for a common IT platform (Parr & Shanks, 2000). Other reasons include a desire for process improvement, data visibility, operating cost reductions, increased responsiveness to customers through improvements in strategic decision making (Parr & Shanks, 2000). Another study by Deloitte Consulting, found that motivations for ERP implementation fell into one of two broad categories: a resolution of technological problems and a vehicle for solving operational problems such as uncompetitive business performance and ineffective business processes (Parr & Shanks, 2000). Others choose to implement ERP because of the seamless integration of all information flows in a company.

It is important to note that companies should consider more than just the technical aspect when deciding whether or not to implement ERP. Due to the large investment typically required, executive officers are likely to be involved in the decision making. A good way to approach the decision is through examination of a business case. The analysis must consider not only the obvious cost/benefit analysis, but also the non-financial factors such as information visibility and flexibility (Taube & Gargeya, 2005)

ERP Critical Success Factors

Many studies examine and define factors critical to ERP success. However, as cited by Nah, Islam and Tan (2007), the three lists in Table 1 stand out as being comprehensive and having merit. The seven broad categories of critical success factors along with all of the subcategories, complied by Nah and Delgado (2006), are given first. Next, similarities with the Twenty-two Critical Success Factors Model and the Unified Critical Success Factors Model are indicated by an X in the blocks where there is overlap. The only area with little overlap is the project management area. Additionally, it should be noted that 4 of the 22 critical success factors could not be directly tied to any of the seven broad categories and are not included in the chart. These factors are vendor support, use of steering committee, partnership with vendor and use of consultants.

Seven Broad Categories of Critical Success Factors (Nah & Delgado, 2006)	Twenty-Two Critical Success Factors (Somers & Nelson, 2001)	Unified Critical Success Factors (Esteves & Pastor 2000)
1. Business plan and vision		
Business plan/vision		
Project mission/goals	X	X
Justification for investment in ERP		
2. Change management	X	X
Recognizing the need for change		
Enterprise-wide culture and structure management		
Commitment to change, perseverance and determination		
Business process reengineering	X	X
Analysis of user feedback		
User education and training	X	X
User support organization and involvement		X
IT workforce re-skilling		
3. **Communication**		X
Targeted & effective communication		X
Communication among stakeholders	X	X

Expectations communicated at all levels	X	X
Project progress communication		X
4. ERP team composition, skills and composition		
Best people on team		X
Balanced or cross-functional team		
Full-time team member	X	X
Partnerships, trust, risk-sharing, and incentives	X	X
Empowered decision-makers		X
Performance tied to compensation		
Business/technical knowledge of team & consultants	X	
5. Project management	X	
Assign responsibility		
Clearly establish project scope		X
Control project scope		
Evaluate and proposed change		
Control and assess scope expansion requests		
Define project milestones		
Set realistic milestones and end dates		
Enforce project timelines		
Coordinate project activities across all affected parties		
Track milestones and targets		
6. Top management support and championship		X
Approval and support from top management	X	
Top management publicly & explicitly identifies project as top priority		
Allocate resources	X	
Existence of project champion	X	X
High-level executive sponsor as champion		
Project sponsor commitment		
7. Systems analysis, selection, & tech implementation		
Legacy system		X
Minimum customization	X	X
Configuration of overall ERP architecture		X
Vigorous and sophisticated testing		
Integration		X
Use of vendor's development tools and implementation methodologies	X	X
ERP package selection	X	X
Selection of ERP architecture	X	
Selection of data to be converted	X	
Data conversion	X	
Appropriate modeling methods/techniques		
Troubleshooting		X

Table 1: Critical Success Factors

ERP Life Cycle Models

ERPs evolve as they make their way through a life cycle, usually starting with conception and ending with a new way of doing business. Cooper and Zmund (1990), present a six phase IT implementation model that begins with Initiation and ends with infusion. Ross and Vitale (2000) developed a five stage model of an ERP with the journey starting with design and ending with transformation. A visual representation of their model is reproduced at Figure 1. Finally, Markus et al., (2000), offer a four phase experience cycle. The stages of each cycle are listed and explained in greater detail in Table 2. In this research, a combination of the phases presented by Ross and Vitale's model and the success measures presented by Markus are used.

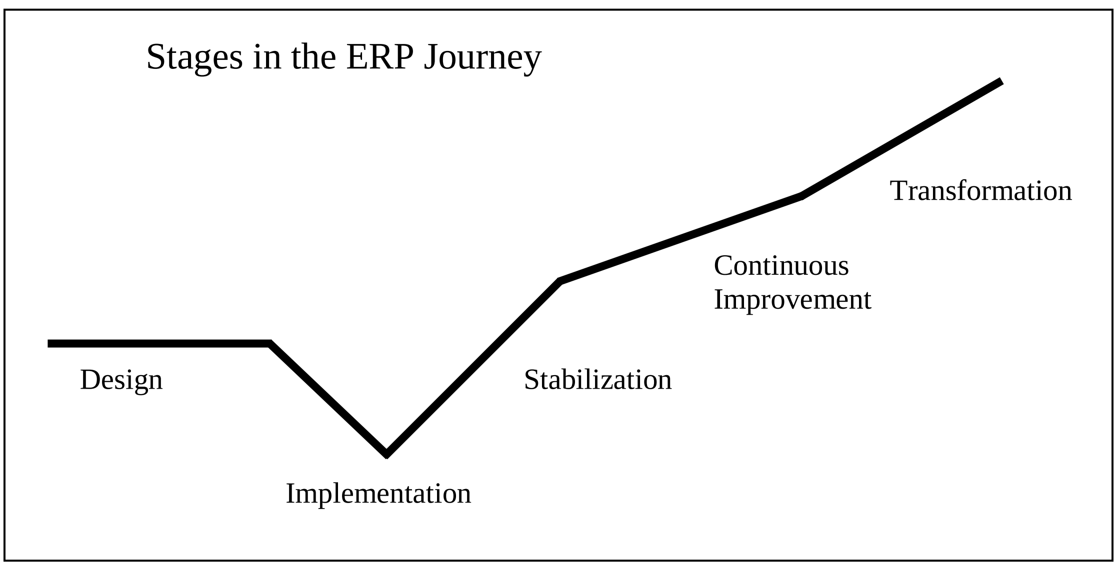

Figure 1, Stages in the ERP Journey Ross & Vitale, (2000)

ERP Life Cycle Models		
Cooper and Zmund (1990)	Ross & Vitale (2000)	Markus et al. (2000)
Initiation	***Design***	***Charting***
Active and/or passive scanning of organizational problems/opportunities. IT solutions undertaken. Pressure to change evolves from organizational need/ technological innovation. Product match found.	Make decisions regarding process change and process integration	Make important business decisions about project objectives, decompose project into manageable chunks, determine budget for project and shakedown phase of each chunk, and an appropriate project leader and /or implementation partner.
Adoption	***Implementation***	***Project***
Rational and political negotiations ensure to get organizational backing for implementation of the IT application. A decision is made to invest in product.	Go Live with new system and business processes	ERP software is configured and rolled out to the organization
Adaptation	***Stabilization***	***Shakedown***
IT application developed, installed & maintained. Organizational procedures revised & developed. Employees trained on both new procedures and new IT application.	Clean up processes and attempt to adjust to the new environment. Provide additional training to users and working with vendors to resolve bugs.	Company make the transition from "go-live" to normal operations
Acceptance	***Continuous Improvement***	***Onward and Upward***
Organizational members are induced to commit to IT application usage.	Add functionality through bolt-ons. Engage in process redesign to implement new structures and roles to leverage the system.	Company captures majority business benefits (if any) from ERP system & plans next steps for technology implementation & business improvement.
Routinization	***Transformation***	
Usage of product is encouraged as a normal activity. Product no longer considered out of the ordinary and IT application is covered in organizations governance system.	Changing organizational boundaries. Leverage of organizational visibility to gain increased agility.	
Infusion		
Increased organization effectiveness obtained, using IT application in more comprehensive & integrated manner to support higher level aspects of organizational work. Product used to fullest potential.		

Table 2: ERP Life Cycle Models

ERP Success

Success of an ERP is defined in various ways, depending on who is defining it. Success may mean staying on-time or under budget or it may represent improving the organizations share of the market as a result of the improved IT (Markus, et al., 2000). Markus et al. (2000), offers measurements to gauge success for each stage of his ERP life cycle model, excluding the charting phase. The corresponding phase from Ross and Vitale is indicated in parentheses after the phase name.

<u>Project Phase Success (Implementation)</u>

- Project cost relative to budget
- Project completion time relative to schedule
- Completed/installed system functionality relative to original project scope

<u>Shakedown Phase Success (Stabilization & Continuous Improvement)</u>

- Short-term (versus long-term) deterioration in key (business) performance indicators (KPIs) such as process cycle times, inventory levels ad operation labor costs.
- Length of time before KPIs and business impacts return to normal
- Short-term (versus long-term) negative impacts on organization’s suppliers and customers such as average time on hold, lost calls, lost sales and customer satisfaction levels.

<u>Onward and Upward Phase Success (Transformation)</u>

- Achievement of business results expected for the ERP project, such as reduced IT operating costs and reduced inventory carrying costs.

- Ongoing improvements in business results after the expected results have been achieved.
- Ease in adapting new ERP releases, other new ITs, improved business practices, improved decision making, etc., after the ERP system has achieved stable operations.

Nah & Delgado (2006) took the seven broad categories of critical success factors and evaluated the importance of each during the four phases of Markus and Tanis' four-phase model. Their findings reveal that ERP team composition, skills and compensation was considered the most important overall. Individually, top management support and championship was found most important during the charting phase while ERP team composition, skills and composition was most important in the project phase. Change management was the most important in the shakedown phase, while ERP team composition, skills and composition was again most important in the onward and upward. At each phase, human capital was a major component of the top ranked category.

Productivity

Output divided by input is the basic productivity equation and the backbone of all productivity measurements and principles (Rosenbaum, 1981). Slight variations are used when calculating labor, capital and material productivity. When finding productivity, you are basically finding the ratio of the real economic value of outputs in the general marketplace to the real economic value of inputs (Rosenbaum, 1981). Rosenbaum (1981) identified five methods for corporate management to improve productivity:

1. Change in management policy
2. Altering the mix or nature of inputs
3. Adding new technology
4. Adding new products
5. Adding new markets

The implementation of an ERP obviously falls into the third category, but simply adding new technology does not automatically improve productivity. An organization may need to prepare for a dip in productivity before any improvements are recognized. Additionally, increasing productivity relies on the effective application of human energy, skills and commitment (Rosenbaum, 1981).

Productivity and ERP Implementation

In studies of the productivity dip during implementation, productivity is typically measured based on what was important to the organization. For example, McAfee (2002), used order response time and on-time completion of an order because they were two of the most important operational performance measures in the organization he was studying. However, as noted by Stensrud & Myrtveit (2003), it is hard to find productivity indicators that allow you to compare apples to apples and we typically use indicators that are easy to collect and count.

Many companies may not see the benefits they expect until a year post implementation and performance problems are more likely if the implementation is done all at one time, called big bang, versus phasing it in more slowly (Cosgrove Ware, 2003). Ross and Vitale (2000) found that all firms experience an initial performance dip, with the typical stabilization period lasting four to twelve months with varying intensity and

length. Gattiker and Goodhue (2005) tested organization task efficiency based on months since ERP go live and found that performance improves over the first year, increasing year by year but at a decreasing rate. It's interesting to note that these authors excluded 18 organizations from the study as their ERP implementation was less than one year old and the assumption was that they may still be experiencing problems.

McAfee (2001), found performance dips during ERP implementations mirrored those during introduction of advanced manufacturing technology. Specifically, performance was significantly different before and after ERP was in place. In his study of a manufacturing firm, he found the fraction of all orders shipped late jumped from 23% to 67% and daily average lead time of orders with a computer increased from 19.97 to 26.46 days, but the standard deviation of shipped orders lead time was unchanged. The production dip bottomed out at about 30 days and then began to improve. Data was only available for 250 days post implementation but at that point improvements to pre-ERP numbers were evident. Performance had improved steadily at a decreasing rate since approximately the 30 day post-ERP timeframe, although it was not clear if steady state, or transformation, had been reached. Additionally, a bulge of decreased performance approximately 80 days after changeover to ERP appeared but the organization attributed it to a severe shortage of a product.

Hitt et al. (2002) used a Cobb-Douglas productivity function to measure productivity across a broad section of organizations before, during and after implementation. Their findings show that productivity during implementation was higher than before and that there was a dip immediately following the implementation. A possible explanation was given that some components of ERP adoption are completed

and operational before the firm declares the project complete or that “belt-tightening” measures embraced in preparation of implementation had a positive result. The length and depth was not explored.

Markus et al., (2000), found that all 16 companies in his study experienced moderate to severe business disruption when their ERP systems “went live.” He found that they had difficulty diagnosing problems and then recovering from them. They sometimes achieved normal operations only by permanently increasing manning and then reducing their expectations about labor efficiency. Overall, the companies were unprepared physically and psychologically for the difficulties of the shakedown phase.

An interesting finding by Markus et al., (2000), was that some companies who claimed implementation success could be considered failures later on. They had implemented on-time or in-budget but in doing so perhaps cut scope or did not reengineer business practices and later on did not realize the business benefits expected. The reverse also held true. An organization that was technically a failure after implementing only 15% of the planned ERP experienced substantial inventory reductions. This finding suggests that companies should be concerned with success at all stages of implementation (Markus et al., 2000).

Moving forward, it is assumed that the productivity dip experienced during an ERP implementation can be reduced by increasing productivity, which is accomplished by increasing output or decreasing input. This assumption is represented in Figure 2.

Figure 2, Productivity Assumption

Human Capital Factors

As identified in the earlier discussion of critical success factors, there are many areas that need attention during implementation. Most of these have some human capital aspect to them and as such, this paper explores how human capital issues specifically effect productivity changes during ERP implementation. Barker and Frolick (2003) focused on personnel issues in a case study of a major soft drink bottler's failed ERP implementation. They identified improper employee involvement, lack of training, inconsistent management support and a lack of good communication as issues contributing to the failure. Other studies have found that management needs to monitor project milestones, targets, and team member performance; tie compensation to team performance; and publicize successes early to help win over skeptics (Nah et al, 2003). Taking these studies into account, as well as other relevant literature, the twelve human capital factors chosen for this study and discussed next are as follows: team composition, training, empowerment, expectations, recognition, manning, communication, social factors, workarounds, resistance, turnover and sabotage.

Team Composition

Implementation teams should be comprised of personnel most familiar with the processes they will be reengineering, versus young inexperienced professional staff even if they possess more advanced educational degrees (Barker et al., 2003). The team should be balanced, representing each effected area of the organization, and include external consultants as well as internal staff so that they can develop the skills necessary for the project to succeed even after the consultants are gone (Nah et al., 2003). Teams should be co-located if possible, have direct access to management and hold regularly

scheduled meetings to share information and build trust among the team members (Nah et al., 2003). In Barker and Frolick's (2003) case study of an unsuccessful ERP implementation, they found team composition to be a significant contributing factor. It may seem difficult to disengage key personnel from their normal duties so that they can focus on ERP implementation, but in the long-run the organization will benefit from greater productivity.

Training

Employees must be trained on the duties they are expected to perform. This applies to the IT staff and teams responsible for implementation and to the employees expected to use the system. Training must also be accomplished on the new business processes inherent in the new system. As part of a case study on 15 firms that had gone live, Ross and Vitale (2000) found that when the organizations were asked what they would do differently, most responded that they would offer more training on how the system would change business processes.

End-user training should be ample and hands-on. It should teach key-strokes and procedures required to complete tasks but more importantly, should provide users with a high-level view and understanding of the business process and their corresponding mappings to the system procedures (Nah et al., 2004). If employees are properly trained the system is more likely to be successful. While some training cannot occur until after implementation, completing as many aspects as possible before the system goes live minimizes the training component of overall productivity dip.

Empowerment

Empowerment, defined as passing considerable responsibility for operational management to individuals or teams (rather than keeping all decision-making at management level), was tested and proven by Birdi et al. (2008), to enhance company productivity. Lawler et al. (1992), and Patterson et al. (2004), tested the effects of empowerment variations (employee involvement and job enrichment) on productivity and also found a positive association. This concept goes along with including employees in the ERP implementation process. If they are invested in the decisions that are made, they are more likely to embrace the change. When minor problems arise, empowered employees are likely to take actions necessary to resolve them quickly. On the other hand, employees who are not empowered and just following directions may not even report the problems. Left unresolved they turn into bigger problems and have a negative effect on productivity.

Expectations

If employees and stakeholders do not have realistic expectations of the implementation process or the desired end-state, they are more likely to be apprehensive or disappointed with the new system. For instance, if employees only hear how great the new system is going to be, they will expect nothing less than greatness. The first time there is a glitch, or when they realize it takes some time and effort on their part to learn the system they will question the validity of what they previously heard. These questions turn to uneasiness and possible disappointment. To prevent this issue and increase the chances of success, efforts should be made to ensure they have realistic expectations. This means telling them the good and preparing them for the bad. In fact, because they

are anticipating some challenges during implementation they may actually formulate potential solutions beforehand. When implementation occurs, they may be pleasantly surprised by how smooth the transition goes. But if there are issues they are not surprised and are prepared to address them quickly, minimizing the productivity dip.

Recognition

Personnel involved in the ERP implementation effort are likely to work extra hours and feel extra pressure or stress to get the implementation right. If they feel management views their efforts as part of their everyday job, they may become bitter about having to carry the burden of the implementation. To keep employees involved in any major effort motivated, they need to feel that their efforts are appreciated (Barker et al., 2003). This can be accomplished by giving simple recognition for a job well done, acknowledgement of meeting a major milestone or some creative, low cost way of identifying management is aware of their efforts. Additionally, recognizing successful efforts in public is good publicity and promotes a positive image of the project to the rest of the organization. Happy employees are likely to be more productive than unhappy employees, keeping the organization as productive as possible.

Manning

Employees should not be expected to keep up with their regular job while accomplishing the enormous workload of an ERP implementation effort (Barker, et al., 2003). Doing so typically requires the employee to work much greater than 40 hours per week resulting in stress and frustration, leading to other undesirable issues. Organizations implementing an ERP system should consider temporarily bringing in extra manpower, whether in the form of consultants to help with implementation or part-time workers to

absorb regular duties, freeing up employees on the project team to focus on implementation (Barker, et al., 2003). Although employees may still choose to put in extra hours, they are doing so because they want to versus being forced into it by management. They become vested in the project, and see it as their job verses just an additional duty that they will get to when they have time. Additionally, their full-time effort helps keep the project on-time, helping to stay in budget and minimizes the productivity dip.

Communication

Communication, in some form, appears on practically every list of ERP critical success factors. It is important that communication is present at every level inside the organization, with every stakeholder outside of the organization and during every phase of the project. While most recognize its importance, it takes dedicated effort by everyone to ensure it happens. When communication is lacking, uneasiness and resistance to change occurs and small problems stay hidden until they are too large to solve easily (Barker et al., 2003). Even employees who are not directly involved in the implementation should be given updates about the progress and given a chance to make suggestions. This enforces the idea that it will be their system (Barker et al., 2003). Managers can also proactively influence beliefs though strategic managerial action such as broad-based information dissemination at training sessions (Amoako-Gyampah, 2004).

Social Factors

Social factors include not only senior management commitment, but also the expectation and pressure from various parties and colleagues to whom the ERP users interact (Chang et al., 2008). Business practices change with the implementation of an

ERP and departments who previously worked in a stovepipe may now find themselves having to work with other departments to complete transactions. For example, the budget office may now have to collaborate with the affirmative action office as part of the hiring process (Furumo & Melcher, 2006). Chang et al., (2008), using questionnaires from over 200 practitioners, found that social factors are the most significant determinant affecting ERP system usage. This study was conducted in Hong Kong, and there may be some issues with application in the United States, but it follows that social factors play a role.

If the predominant feeling in an organization is that the ERP system is negative, then people who may have otherwise embraced the system may not do so because of a desire to fit in or go along with the norm. However, if leadership can sway social factors in their direction it may be a powerful tool in achieving a successful implementation and minimizing the dip in productivity.

Workarounds

Employees who do not feel the ERP system is a good fit, may revert to informal, nonintegrated systems such as spreadsheets or legacy systems. These may meet local needs, but do not facilitate coordinate beyond local boundaries and therefore cause a performance drop (Gattiker & Goodhue, 2005). Workarounds may also lead to costly duplication of effort or system failure which reduces productivity (Peslak et al., 2007). Bendoly and Cotteleer (2008), found that when faced with a strong task technology misfit, managers show a strong intention to circumvent new systems. The perceived ease of circumvention factors significantly into the timeframe of the intended circumvention. Also interesting is that users worked around the system more as they learned the system more and figured out how to work around it.

Bendoly and Cotteleer (2008) contend that in some cases such unintended approaches may be beneficial to both individuals and the organization. However, in situations where a desired result of the ERP implementation is to reduce variation and improve control, actions that may seem to benefit the user and possibly the organization are actually extremely disruptive to the global operational goals of the firm (Bendoly & Cotteleer, 2008).

Resistance

Resistance can be potentially very damaging to an ERP implementation and should be monitored and addressed immediately if it becomes an issue. It can be especially damaging if those resisting hold key positions in the organization, are informal leaders or senior employees who others look to for guidance. Ross and Vitale (2000), found that persons in mid-level positions were most susceptible to job changes and that some are very uncomfortable with it. Personnel used to being the “go-to” person for information no longer feel important because individuals can access the information themselves. Additionally, personnel sometimes feel like the computer dictates how they do things resulting in resistance because they do not want a computer running the business.

Furumo & Melcher (2006), talked with three dissenting team members involved with an ERP implementation and found several reasons for resistance. One member was from the IT department and was afraid the new system would give too much authority to user departments while she still was responsible for maintaining it. On the other hand, the other two users were on the opposite end and believed they were being asked to take on too much responsibility. Each of these situations could be addressed and turned

around with better communication and education of the new system and processes. However ignoring the situations result in a force working against the implementation, and increased the depth and duration of the productivity dip.

Turnover

Employees frustrated by the ERP implementation process, including high level managers, may choose resignation over suffering through the process (Barker, et al., 2003). An organization that loses valued employees not only loses experience, but also incurs great costs to hire and train new employees. Markus et al. (2000), found adopters frequently reported losing key IT specialists and user representatives working on the project while the project was going on, despite handsome retention bonuses. He also found that some IT specialists thrive on project work and left organizations after implementation was complete.

Organizations need to consider incentives to keep employees through implementation and after. As mentioned earlier they can use recognition, or consider alternative means such as presenting new challenges for IT specialists who thrive on that. Also, keeping employee morale high with effective communication efforts can help minimize turnover. Given that productivity is output divided by input, keeping new employee costs (inputs) down helps minimize the productivity dip.

Sabotage

Furumo & Melcher, (2006), studied changes to the social structure of an organization after ERP and found that resisting team members can influence the success or failure of an implementation. In their case study of a failed implementation, the project manager reported she was unable to do her job partly due to sabotage of her

efforts by three team members who were 5-8 years from retirement, had been employed by the university for 20 years or more and were well ingrained in the legacy social structure. They wanted to leave things the way they were as the new system could not add value beyond what they already had and they did not agree with the new business processes being implemented along with the ERP. They contributed to the failure of the implementation by monopolizing meetings and their negative attitude created tension for others on the team. They also actively solicited other team members outside of meetings for their support against the project.

Ross and Vitale (2000), found that some employees had difficulty understanding how their behaviors could affect operations several processes removed from theirs and as a result, they introduced contaminated data into the system. An example presented was where a firm's product in inventory could not be shipped because the system did not believe it existed. As this example shows, sabotage does not have to be deliberate to be damaging and its existence definitely makes minimizing the productivity dip difficult.

Expeditionary Combat Support System (ECSS)

Implementing the Air Force's logistics ERP will be a challenging and monumental undertaking from a number of perspectives—collapsing 400 plus legacy systems, change management, reengineering business processes, and adopting industry best practices (Dredden & Bergdolt, 2007). However, it allows for an integrated common database, alleviating errors and wait time in transferring data between logistics systems. The Air Force logistics ERP system, along with the demand planning and repair scheduling programs is ECSS (Nunnally & Thoele, 2007). Implementation began in May

2007, and rollout is expected to begin in 2010 lasting through 2013. As with ERPs in the civilian sector, the Air Force should expect drastic changes to their business processes as ECSS is implemented (Nunnally & Thoele, 2007). According to Mr. Grover Dunn, it will touch every process we operate and will make major changes to most of these processes (Dunn, 2007).

Summary

ERP is a comprehensive "standardized" software solution that includes industry best practices, ties an entire organization together, runs off of a common database, and shares data in real time. Today, ERP implementation is so widespread that it has gotten to the point where businesses are afraid of the consequences if they don't adopt ERP. If time is spent on choosing the correct tool and ensuring the data is good, in addition to focusing on the critical success factors, many benefits can be realized. However, there are stages to an implementation and productivity may dip before it begins to improve. Managers need to be careful in defining success and manage each stage of the implementation.

Given the prevalence of human capital factors in many of the critical success factor lists and in the findings of studies on previous implementations, managing the various aspects of human capital is very important to controlling the depth and duration of any productivity dip. While it was not possible to review all information available on ERP, productivity and human capital, an effort was made to capture the big concepts and include differing schools of thought.

III. Methodology

Overview

The Air Force logistics community anticipates roll-out of a new ERP system, ECSS, in 2010. Given the nature of today's operations tempo, the Air Force cannot afford to suffer a dip in capability or productivity when this system comes on-line. In an effort to plan for and minimize any productivity dip during ECSS implementation, it is necessary to define the potential dip, duration and depth, and identify issues that may contribute to it. This section details how the research was accomplished.

Experimental Design

The methodology chosen for this research problem was the multiple case study method. This method was selected since it is well suited to exploring a phenomenon of interest and doing qualitative analysis on empirical data (Ellram, 1996). For case studies, five components of research design are especially important (Yin, 2003):

1. Study's questions
2. Study's propositions
3. Study's unit of analysis
4. Logic linking the data to the propositions (Design of Data Collection)
5. Criteria for interpreting the findings (Data Analysis and Interpretation)

Each of these components will be discussed in detail next.

Research Question

A research design is a logical plan for getting from here to there, where here may be defined as the initial set of questions to be answered and there is some set of conclusions about these questions (Yin, 2003). For this reason, taking the time to clearly

and articulately define the researcher's questions may be the most important part of the research. If the researcher does not know where they start, they will have trouble getting to their destination or may end up somewhere they did not want to go.

The research question that best defines where this journey starts is as follows: How do companies minimize the human capital aspect of productivity disruption during implementation of an Enterprise Resource Planning System (ERP)? This question was developed partly from discussions with personnel responsible for implementing ECCS and partly from a literature review on previous implementations. However, the literature appeared to be lacking on information specific to controlling the productivity dip during implementation and the expected depth and duration of the dip.

Propositions

A proposition directs attention to elements that should be examined within the scope of study (Yin, 2003). It helps the researcher narrow their focus and vectors them in the right direction to answer the research question. In this situation, the next step was to define propositions stemming from the human capital factors discussed earlier. The resulting propositions developed from the literature are stated below:

P_1: There is a positive correlation between implementation team composition and output. Proper implementation team composition increases output which decreases the productivity dip during implementation.

P_2: There is a positive correlation between employee training and output. Proper training increases output which decreases the productivity dip during ERP implementation.

P_3: There is a positive correlation between implementation team empowerment and output. An appropriate level of empowerment increases output which decreases the productivity dip during implementation

P_4: There is a positive correlation between expectations and output. Realistic expectations increase output which decreases the productivity dip during ERP implementation.

P_5: There is a positive correlation between employee recognition and output. Effective recognition increases output which decreases the productivity dip during ERP implementation.

P_6: There is a positive correlation between manning and output. Dedicated manning increases output which decreases the productivity dip during ERP implementation.

P_7: There is a positive correlation between enterprise-wide communication and output. Effective communication increases output which decreases the productivity dip during ERP implementation

P_8: There is a positive correlation between social factors and output. Negative social factors decreases output which increases the productivity dip during ERP implementation.

P_9: There is a negative correlation between workarounds and output. Workarounds decrease output which increases the productivity dip during ERP implementation.

P_{10}: There is a negative correlation between resistance and output. Resistance decreases output which increases the productivity dip during ERP implementation.

P_{11}: There is a negative correlation between turnover and output. Turnover decreases output which increases the productivity dip during ERP implementation.

P_{12}: There is a negative correlation between sabotage and output. Sabotage decreases output which increases the productivity dip during ERP implementation

Figure 3 shows the research model, and the effect each human capital aspect is expected to have on productivity. Team composition, training, empowerment, expectations, recognition, manning, communication and social factors are expected to have a positive correlation with output, increasing productivity when it is a positive factor during implementation. Conversely, when it is a negative factor during implementation it reduces output and reduces productivity. Workarounds, resistance, turnover and sabotage are negatively correlated with output and as they increase, decrease output which decreases productivity.

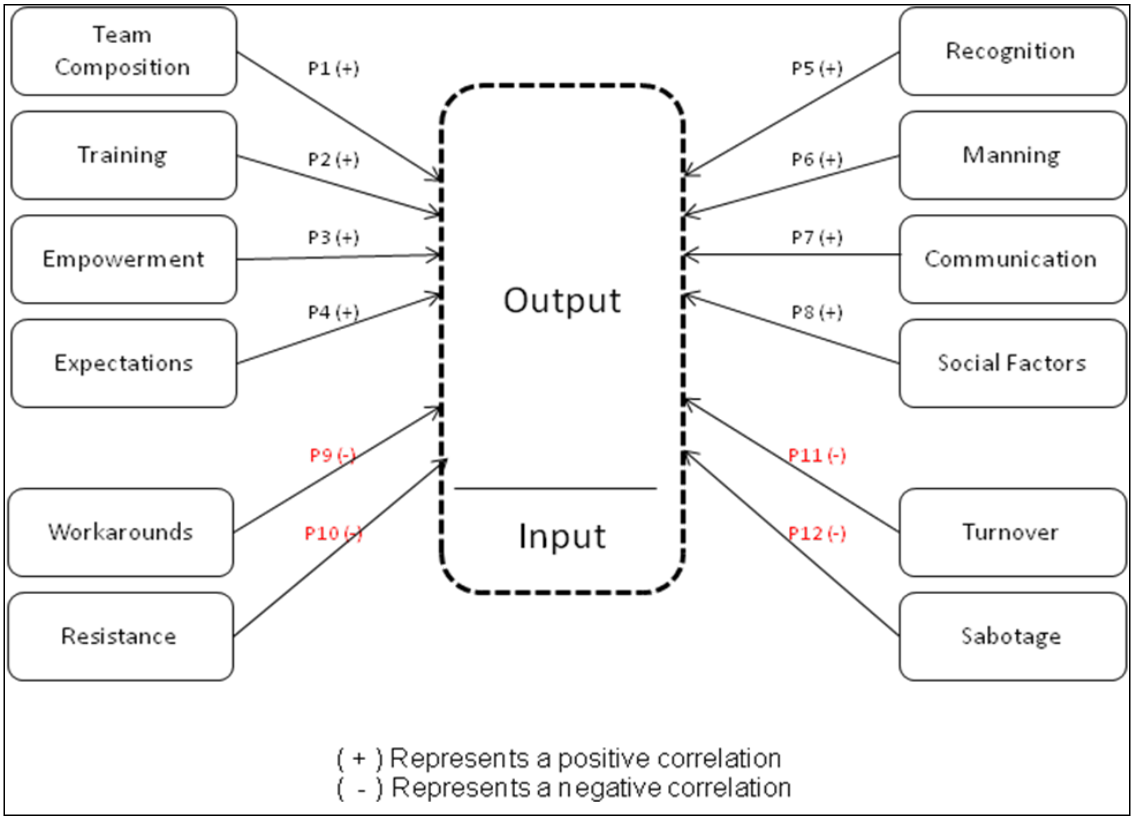

Figure 3, Research Model

Unit of Analysis

As a general rule, the tentative definition of the unit of analysis (and therefore the case) is related to the way the researcher has defined the initial research question (Yin, 2003). As Yin also points out, the researcher can go in several different directions with the same topic depending on the unit of analysis chosen. Since the intent of this research is to provide the Air Force with information to help them minimize a productivity dip across the enterprise, the unit of analysis is the organization level.

Design of Data Collection

The design of data collection is the researcher's plan for how to collect data and includes everything from how many case studies to conduct to what questions to ask. In

this case, multiple versus single case study method was used for several reasons. First, it can produce more compelling evidence making the study more robust. Second, finding replication among the cases help prove reliability (Yin, 2003). In this situation, six organizations were included in the study, with personnel at two levels being interviewed, for a total of twelve interviews.

Potential organizations were identified for inclusion in the study through a variety of means. Local consulting companies were asked for leads on ERP implementation completion stories and personnel working on the ECSS project provided contacts in organizations that they knew had implemented an ERP system. Additionally, organizations were contacted based on information found in literature indicating they may be a good fit. Organizations were selected for inclusion based on the following criteria:

1. Implemented an ERP system in the last 10 years
2. Able to address productivity before and after ERP
3. Ease of implementation (wanted both smooth and turbulent transitions)
4. Knowledge of successes/problems following implementation
5. Physical proximity to researcher (preferred to interview in person although travel was not ruled out)
6. Type of industry (did not want to rely too heavily on one industry)
7. Availability/willingness to participate in study

Once an organization was selected for inclusion in the research, a letter was sent to the individual to be interviewed thanking them for their participation, giving an overview of what is being researched, confirming the time and location of the meeting and

providing a copy of the questions to be asked. Questions were created based on findings in the literature and several questions were adopted from previous studies by Bernroider (2008), Nah et al. (2007), Nah & Delgado (2006), and Furumo & Melcher (2006).

Yin (2003) states that four tests have been commonly used to establish the quality of any empirical social research. Many of his recommended tactics were employed to ensure the research was rigorous and will sustain scrutiny. Each of the four tests are addressed below.

Construct Validity

To ensure success in measuring the human capital variables that contribute to productivity, several tactics were utilized. First, multiple sources of data were obtained to enable triangulation. This data came from answers to interview questions, observed body language during interviews, any information obtained prior to the. Second, a chain of evidence was established and maintained. Both the research advisor and reader provided an external verification that there was, indeed, a logical flow and "chain" of evidence" (Ellram, 1996). Finally, the personnel interviewed reviewed a draft of the report on their specific case study and to verify that the facts contained in the report were accurate and to ensure there were no details that identified the organization to ensure their anonymity.

Internal Validity

Internal validity in case study research relates to making proper inferences from the data, considering alternative explanations, use of convergent data and related tactics (Ellram, 1996). This tactic occurred during the data analysis phase, and was done by looking at each specific area across all cases and by weighing the views of both individuals at the organization to insure there was consistency.

During the interview, each senior level employee was asked how influential they believed the twelve human capital components were on productivity during the ERP implementation. They were asked to indicate influence by assigning a number from -4 to 4, for each component. A definition for each possible score is detailed in Table 3.

Score	Definition
-4	Human capital factor was a very negative influence on productivity
-3	Human capital factor was between a moderate and very negative influence on productivity
-2	Human capital factor was a moderate negative influence on productivity
-1	Human capital factor was between a moderate negative and no influence on productivity
0	Human capital factor was no influence on productivity
1	Human capital factor was between a moderate positive and no influence on productivity
2	Human capital factor was a moderate positive influence on productivity
3	Human capital factor was between a moderate and very positive influence on productivity
4	Human capital factor was a very positive influence on productivity

Table 3 –Score Definitions

In order to determine the overall significance of each factor, and to avoid canceling out of both positive and negative scores, the absolute value of the score for each company was summed. Using data from all six companies, a score between 0 and 24 was possible for each component. Overall significance of each component, and hence each proposition, was determined based on the ranges detailed in Table 4.

Value	Significance	Proposition
0 – 5	Little to no significance on productivity	Not Supported
6 - 11	Moderate influence on productivity	Somewhat Supported
12 - 24	High influence on productivity	Fully Supported

Table 4 – Proposition Value Range

It may appear that the range is slightly skewed, with the threshold for “high influence on productivity” being set too low. However, the scale was built this way intentionally. The interviewer observed that two interviewees had much to say about each component’s influence on productivity, but when it came to assigning a number they consistently scored lower than their descriptions would indicate, especially compared to the descriptions and subsequent scores given by the other four interviewees. In order to correct for this rating deflation, the ranges are skewed slightly in favor of the high end. In order to be in this highest tier, there must be some ratings of 3 or 4, but the range allows for a couple of lower ratings also.

External Validity

External validity is addressed in the research design and the fact that a multiple case study was conducted. Replication of observations across multiple cases will mean external validity has been met and that results can likely be generalized outside of the studied cases.

Reliability

Reliability is achieved when the same case study is done, following the same procedures, and the results are the same. The goal of reliability is to minimize the errors and biases in the study (Yin, 2003). The only way a study can be duplicated is if thorough documentation is available on process, procedures and analysis. Use of a case

study protocol and development of a case study database are used to capture and maintain this data.

The case study protocol basically details every step taken and the database captures all research collected, regardless of the method. The literature review was used to develop insightful questions. Questions were developed and reviewed before the first interview, but the interview was conducted in an open-ended nature. An interview guide was created for use in the interview, was included in the database and was a part of the protocol.

Interview questions were focused on how productivity changed with ERP implementation, how bad did productivity get, how long before an upturn occurred, how long until productivity reached pre-implementation levels, efforts on their part to avoid human capital issues, problems identified after the fact with human capital and overall lessons learned regarding the human capital element of the productivity during implementation.

Data Analysis and Interpretation

The final step in research design is to determine how the analyzed data will be interpreted and what criteria will be used (Yin, 2003). As data was collected from interviews, it was analyzed and compared to data already received. Common themes were identified and differences in responses were explored. The use of matrices and charts was used to more clearly present the information and provide the reader with the ability to draw their own conclusions.

Background Information on Individual Case Studies

This section gives a general description of the six companies that participated in the research. Since the organizations are anonymous, the information is limited and an overview is provided at Table 5. After interviews were completed, the conversations were transcribed and forwarded to the interviewees to review for accuracy and final approval of the data for inclusion in this research.

Company	Industry Type	Approx. Number of Employees	Time Since Implementation	Successful Implementation
A	Global Technology	23,000	9 Months	Yes
B	DoD Supplier	10,000	3 Years	Yes
C	Pressure Sensitive Technology Manufacturing	2,400	9 Years	Yes
D	Global manufacturing & Technology	138,000	1 year	Yes
E	Global Mechanical and Electrical Systems	2,000	3 Years	Yes
F	Branded Foods Company	25,000	4.5 Years	Yes

Table 5 – Case Study Participants

Company A

Company A, a global technology company, implemented an ERP system eight months ago at a European location. The new system was intended to be off-the-shelf generic so that the company could benefit from software upgrades by the vendor. But, the business team drove so many customizations that the new system pretty much provided the same functions as the previous one. Some functions were preformed

following a different series of steps, but there was no loss of functionality. There are also many things the new manufacturing system does that the old system did not do, including providing one version of the order, flowing continuous manufacturing support, and a kanban manufacturing material replenishment support. Additionally, it added manufacturing data to the data warehouse for improved user reporting, provided better planning data to reduce on hand inventory, greatly improved supplier purchasing and payment data management, and added a supplier web portal for managing supplier orders and invoices. The case study interviews were conducted in-person at the business location. An ERP project team member was interviewed on 8 April 2009, and the ERP program director was interviewed on 10 April 2009.

Company B

Company B, a Department of Defense Supplier, implemented an ERP system three years ago. It was a very large scale implementation and changed not only the tool employees used to do their job, but most business processes as well. The new SAP system went live approximately three years ago, and the organization is still struggling to get productivity on track. The case study interviews were conducted, in-person at their location, with a company manager and an inventory management specialist on 22 April 2009.

Company C

Company C is a global producer of pressure-sensitive technology, self-adhesive base materials and self-adhesive consumer and office products. This company has implemented several ERPs, but the interviews focused only on the ORCLE implementation done in 2000. The case study interviews were conducted with the ERP

program director and a customer service manager, in-person at the company, 23 April 2009.

Company D

Company D, a global manufacturing and technology company, implemented an ERP system in June 2008. It impacted one business group, at two plants, for the first wave of implementation with the others rolling out over the following 9 months. The case study interviews were conducted over the phone. The IT Lead was interviewed on 24 April 2009 and a lower level system user was interviewed on 27 April 2009.

Company E

Company E, a world leader in mechanical and electrical systems for various markets, implemented their most recent ERP system 3 years ago. During implementation there was a rule that there would be no base code corrections and the implementation team worked hard to comply with this. The new system was Oracle based, and was implemented because the existing system was obsolete. The old system did not perform basic necessary functions such as producing a list of what to ship. Users had to extract data to Access, to then manipulate it into a usable form. Additionally, it was not Open Data Base Connectivity (ODBC) compliant and these issues were significant better after implementation. Regarding shipping and some other operational processes, there was not much of an improvement. For this reason, users did not necessarily view the new system as a gain. The case study interviews were conducted over the phone. The applications manager (who has been very involved in several ERP implementations) was interviewed on 8 May 2009, and a business analyst was interviewed on 18 May 2009.

Company F

Company F, a leading branded foods company, went live with their ERP system in 2004, after a pilot rollout in 2002 and planning for two years before that. The pilot impacted one business unit, and the others rolled in with the 2004 big bang implementation. The implementation converted five major and numerous subsidiary legacy systems into one system. Although the company did experience issues during the implementation discussed for this case, they have moved on to become one of the leading organizations at implementing a new system. The case study interviews were conducted over the phone. The VP of Business Transformation was interviewed on 14 May 2009, and an inventory control specialist was interviewed on 13 May 2009.

Summary

This chapter discussed the methods used in conducting the research to answer the overall research question. The chapter started out with information on the case study research method and why it was the appropriate method for this particular research. The twelve propositions were presented, and then the research model showed how the propositions were linked to the overall research question. Next, the chapter discussed the method of data collection, including how companies were chosen to be in the study, how the interviews were conducted and how the researcher ensured the information was accurate. The chapter concluded with a brief overview of the six companies interviewed for this research.

Chapter IV. Analysis and Results

In this chapter, the results from the case studies are discussed. First, the data on the productivity dip and duration is examined in an effort to determine what a company should expect. Next, the researcher briefly describes how much of the productivity dip is attributed to human capital factors. The majority of this chapter is dedicated to examining each of the twelve human capital factors. One by one, each factor is looked at across each of the companies and commonalities and differences are presented. Finally, the factors are looked at in a rank order from most to least impact during implementation.

Productivity Dip Analysis

Defining depth and duration of the productivity dip proved to be a difficult task for the six companies in this study. In most cases the companies had only loose dates for when they went live, bottomed out and then hit pre-implementation productivity levels. Additionally, they could not articulate what constituted lost productivity and did not have measurements in place to track it during the implementation. Some were able to provide anecdotal information on the severity of productivity based on processes that were hard broke after go-live.

Table 6 provides a snapshot of the approximate date each company went live, when they reached the lowest point in the productivity dip, the date they reached pre-implementation levels and then the duration of the dip. Given each company did not maintain metrics to measure productivity, quantitative data was not available to calculate the actual depth of the dip. However, the depth is categorized as average or significant, based on the information received during the interviews. If an organization had numbers suggesting a serious impact on productivity, or if they themselves classified the dip as

significant, the researcher labeled it significant. Conversely, if an organization had numbers suggesting the dip was as expected or the company themselves classified it as average, the researcher labeled it as average.

Company	Go-Live	Bottom of Productivity Dip	Pre-Implementation Level	Duration of Dip	Depth of Dip
A	11 Aug 08	18 Aug 08	11 Sep 08	1 Month	Significant
B	2006	2008	2009	36+ Months	Significant
C	1 May 00	15 May 00	1 Aug 00	3 Months	Average
D	June 08	Unknown	Unknown	Unknown	Average
E	April 06	June 06	Sept 06	5 Months	Significant
F	15 Nov 04	31 Jan 05	15 Mar 05	4 Months	Average

Table 6 – Productivity Depth and Duration

At company A, management wanted to avoid a dip. Productivity was measured by units out the door based on resource capacity compared to hitting customer expected delivery dates. At one week post implementation productivity bottomed out, down 88% and orders 30 days late, and then began to climb back up. At approximately 4 weeks post implementation they were producing numbers equal to pre-implementation, and at 7 weeks post implementation they reached production rates never seen before, producing 25% more than before the ERP was implemented.

Although the implementation was successful overall, the productivity dip during implementation was longer and deeper than they had planned for or expected. Interviews suggest that a set of circumstances beyond their control, including a ramp-up because of increased customer orders, contributed to the dip. However, human capital issues were

also identified as playing a role in the decline, recovery and eventual record setting production during implementation.

At company B, productivity dips were significant, lasting longer than expected and reaching lows not seen in decades. Additionally, three years post implementation productivity is still below pre-implementation levels. However, the implementation was considered successful and some customers are benchmarking off of them, amazed that implementation went as well as it did considering the magnitude of the project. Specifically, they process more contracts and parts than perhaps anyone else in the commercial industry. Significant issues with the IT interface/modification of COTS system to meet DoD and business requirements contributed to the extended dip. However, human capital issues were also identified as playing a role in the depth and duration of the productivity dip. Overall, it was recommended by the manager that, "an organization should take a worst case scenario when predicting a dip." Metrics used to determine productivity were item availability, impact on customer mission and backorders (duration and number outstanding).

At company C, there were not any formal performance measurements for before and after implementation, so evidence of productivity dip at the organization level is more anecdotal. Productivity bottomed out approximately 2 weeks after go live and reached pre-implementation levels at about 3 months post go-live. The organization measured success by implementing on time and within budget. According to the ERP Program Director, "human capital accounts for 75-85% of the dip when using COTS software." Meaning, if you are using commercial software and implementing industry practices, the technical and business process piece of it has already been tested and

should perform fine. However, how it is received and how it is used varies at each company and falls into this human capital area.

At company D, there were again not any productivity measurements tracked during implementation, as productivity measurements were one of the deliverables the organization hoped to achieve with the ERP implementation. Productivity took what was considered an average dip during implementation and human capital issues were identified as playing a role in the dip. Management watched what is called the "red-zone" report to track transactions during implementation. However, they did not know what performance was before implementation so they could not compare to post implementation productivity. They were able to tell that the new system improved the per person productivity

At company E, productivity was measured by shipping, on-time delivery and financials. Although specific numbers were not available, estimates have the dip bottoming out at 2 months post implementation, reaching pre-implementation levels after 5 months and then continuing to climb even today, where they are approximately 80% more productive then before the ERP system was implemented. Also, there were some perceptions by management that the implementation was bad because of the struggle they had the first month getting hardware availability straightened out. While the company expected a productivity dip during implementation, it ended up being longer and deeper than they had planned and they went over budget. However, the project was considered successful overall. A task force of about 40 people were put together to resolve issues with production after go-live.

At company F, productivity bottomed out about 2.5 months post implementation and reached pre implementation levels at 4 months. According to the VP of business transformation, “success is arbitrary because you don’t see it immediately and it takes months and years before you start getting best-in-class metrics.” More than 4 years post implementation the project is definitely considered a success. At the time it wasn’t a rousing success, but also not a failure. Most issues had to do with pricing and invoicing accuracy to the customer which is a perception to the customer that you don’t have your ducks in a row. However, they did not experience any significant setbacks.

What company F does now, in response to what they learned over the last few years, is plan to mitigate the productivity dip by mitigating circumstances that lead to a dip through simplicity at their startup. In addition to communication and training, these three things make go-lives a non-event now. According to the VP of Business Transformation, “You have to plan for the dip. It is going to happen. A lot of what happens depends on the company giving itself a shot. Don’t set yourself up for failure by running the most complex operation the first week.” He said that sometimes the technical folks will want you to do this to test the system, but you need to make sure the customer is happy. “Simplicity is key.”

Table 7 summarizes the measurements used to gauge productivity during the implementation process. There is only overlap in one measurement, and company C and D did not identify any measurements tracked during implementation. Reasons for the differences are likely that they are different industries, have different priorities, have access to different data and finally that their customers have different priorities.

Company	Productivity Measurement
A	• Number of Units out the Door • Meeting Customer Delivery Dates
B	• Item availability • Impact on customer mission • Backorders (duration and number)
C	• N/A
D	• N/A
E	• Shipping • On-time delivery • Financials
F	• Meeting Customer Delivery Dates

Table 7 – Productivity Measurements

As seen in Table 8, the productivity dip lasted anywhere from one month to 36+ months, assuming the unknown length at company D fell within that range. Additionally, three of the companies considered the depth of the dip to be significant, and three rated it average. It should be noted that the three shortest lengths do not correspond to the three average depths. In fact, the shortest dip was considered significant, given the great impact on the organization. Not surprising is that the longer dips, 5 months and 3+ years were considered to have significant impact.

Duration of Productivity Dip	Company
Unknown	D
1 Month	A
3 Months	C
4 Months	F
5 Months	E
3+ Years	B

Table 8 – Duration of Productivity Dip

Given the diversity in these dips, and the fact that one company could not even produce an estimate as to the duration, it is difficult to define the depth and duration of an average dip. To take a simple average, it is necessary to remove the outlier of company B and again assume that company D would fall within the range of 1 – 5 months. This generates an average of just over 3 months. Additionally, it can be stated that at a minimum all companies will experience some degree of productivity dip.

Interviewees were asked to put a percentage on how much of the productivity dip during an ERP implementation is attributable to human capital factors. As seen in Table 9, the percentages given range from 15% at company D where implementation suffered many issues with the software, to 80% at company C where leadership believes using COTS software removes most other issues. Averaged out, you get 47% of a dip attributed to human capital factors. This is a significant contribution. If this is anywhere close to correct, it means a company can address almost half of the productivity dip by simply managing the human capital aspect of the implementation. In order to do this, a company must first know how to address the various human capital factors.

Company	Human Capital Contribution
A	75%
B	30%
C	80%
D	15%
E	30%
F	50%

Table 9 – Human Capital Contribution

Human Capital Factor Analysis

P_1: There is a positive correlation between implementation team composition and output. Proper implementation team composition increases output which decreases the productivity dip during implementation.

Implementation team composition was identified by each of the companies as having a positive effect on productivity during ERP implementation. The ERP program director at company A went so far as to say "the implementation team is who made the project a success. They were the ones who got the curve moving back up after reaching the low point." The scores for team composition are given in Table 10, and range from 1 to 4. Company B gave one of the lowest ratings, and it is important to note that they consistently scored areas between 1 and -1, even though other qualitative responses indicate a more significant impact on productivity. Company F also gave a rating of 1 and the Vice President of Business transformation stated, "the business knowledge and back end support from the technical personnel kept them from catastrophic problems." The productivity did suffer during implementation, but the implementation team kept it from being worse than it would have been without them.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Implementation Team Composition	+4	+1	+2	+4	+3	+1	15

Table 10 – Implementation Team Composition Ratings

There were five team characteristics repeatedly identified as reasons for the team's positive contribution to productivity during ERP implementation. These common

traits are summarized in Table 11 and are presented in order from most to least often mentioned. Note that the absence of an X for an individual company does not necessarily mean they lacked that specific aspect, just that they did not specifically cite it as a reason for the success of team composition.

Shared Implementation Team Factors	A	B	C	D	E	F
Core Team Members	X	X	X	X	X	X
Representation from Each Function	X	X	X	X	X	X
Knowledge Transfer to Local Users	X	X	X	X		X
Support after Implementation	X		X	X		X
Traveled to Implementation Site	X		X			

Table 11 – Shared Implementation Team Factors

First, each team consisted of a set of core members. These were people that had implemented ERPs in the past and had experience to draw from. Additionally, their entire focus was on the implementation. Team composition varied from all in-house employees to a mix of in-house and contract personnel. At company F, the team consisted of 20% consultants, 20% technical personnel and 60% application experts. Next, the team had representatives from each functional area. This presence ensured expertise in all areas, provided credibility to the rest of the organization that all interests were represented and ensured decisions made by one functional area did not have negative effects on another.

Knowledge transfer to local users was given as a reason for success in several cases. Although it seems obvious, if the implementation team does not ensure there is someone on-site when they leave that can address future problems, the company will not be as productive as they could otherwise be. This goes back to the previous example of waiting for support personnel to get to work. Whether it is in the form of super users or local information technology professionals, having knowledge locally is essential.

Also identified as important was support by the team after implementation. Although most companies train and practice before going live, things always happen that were not planned for. By providing support immediately after go-live, users know they can rely on the team when issues arise. Additionally, this team is usually the most prepared to overcome issues and their support minimizes lost productivity because of unresolved problems.

Finally, and along the same lines, is the team traveling to the implementation site. While many issues can be handled over the phone or internet, sometimes just time zone differences make it difficult. The ERP program director at company C stated, "a location could not close out an order or complete a required action because they were waiting for technical support in another country to get to work in the morning." The companies that did not give this reason for their success may not have done so because the implementation site and the implementation team were co-located.

Each of the companies interviewed indicated that the implementation team composition had a positive effect on productivity. In other words, there was a positive correlation between strength of the implementation team and output. This positive effect on output increased productivity, or at least kept it from going lower. The

implementation teams did this by quickly fixing problems minimizing down time, transferring their knowledge to local users so that they too could quickly fix problems, and having a core of cross-functional experts who could draw on previous experiences, anticipate potential problems and prevent decisions with unintentional negative impacts on other functions in the company. With an overall score of 15, this proposition is fully supported.

P_2: There is a positive correlation between employee training and output. Proper training increases output which decreases the productivity dip during ERP implementation.

When it came to training, every company felt they could have done it better and that their shortcomings in training had a direct result on the productivity dip during implementation. The ratings given by each company are detailed in Table 12, and range from -4 to 0 with company F giving the least influential rating. Company F scored this area neutral because they put a lot of emphasis on training but overall felt it was lacking and that they could have done better. According to the VP of Business Transformation, “training overall was average, but in order to avoid a dip the training has to be above average.” The reason training had less of a negative impact at company A is that they also placed a great deal of emphasis on training and did some things right. For example, they did an extensive amount of hands-on training, training was conducted immediately prior to go-live and training continued after go-live with experienced people in every function who knew the system well, sitting side-by-side for an extended period of time with key users to help them through changeover.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Training	-1	-2	-2	-3	-4	0	12

Table 12 – Training Ratings

Where company A fell short was giving their canned training to non-English speaking, low education, low skill-level personnel. Additionally, the ERP program director said “they made a major mistake in not testing warehouse workers after training.” Employees in all other areas were tested for comprehension, but because of the language barrier this group was not. After go-live, when problems surfaced, they were retrained and then tested. The pass rate was only 50%, suggesting it was probably even lower after the first time through.

There are three common reasons, see Table 13, that training had a negative impact on productivity. First, the method of instruction was inadequate. The situation with company A discussed above falls into this category. At company B, there was job based training, and changes to business practices were explained well, but there was not any hands-on training where users got to work with the system. The first time they used it was when it went live. The ERP program director at company C stated “it is very important to do live training or else training becomes an individual’s third or fourth priority.” For this reason, he felt very strongly that the train-the-trainer method of instruction they used was inadequate and that the training “became less effective as it got lower in the system.” This led to a loss of productivity. Additionally, there was a great

deal of emphasis on keeping costs down so training is often done over the web, which was not as effective.

Shared Training Factors	A	B	C	D	E	F
Inadequate Training Method	X	X	X	X	X	X
Training not Comprehensive		X	X	X	X	
Implementation Team not Trained			X	X	X	

Table 13 – Shared Training Factors

Company D hired professional trainers but they did not possess all the necessary skills. According to the IT Lead at company D, a manufacturing company, "to be successful, trainers need to know the product they are training, must have basic trainer skills, and must know manufacturing." Their trainers did not know manufacturing and because they could not relate to the trainees the training fell short. At company E, the training was designed as learn-as-you-go. Employees were told here is your job, hit this button, then this one. Most of the training done at company F was with project teams and super-users within the business unit using train-the-trainer. Customer Service received the most training, and was able to go into the system in a testing environment and get comfortable with the system before go-live.

A lack of comprehensive training was a problem for all but companies A and F. At company B, there was a standard training package used for all employees. A company B manager said "the training was good for higher level employees, but not as good for the lower level ones." They received many hours of training on the changes to

business practices. However, the processes quickly changed after go live, and continue to change today, rendering their training useless.

Company C attempted to provide comprehensive training, but employees were required to go into a test system and practice transactions. Management pushed the test system and many employees responded that they were comfortable with it, even though management could see they had not used it. When their internal audit team solicited feedback from the users on their readiness to go live, they found users were not comfortable and the go-live date was pushed back.

Companies B, C and D experienced problems with employees not having basic computer skills such as the ability to sign on to a computer. Many employees were not computer literate and only knew how to operate the old stand-alone systems. Because it was assumed that everyone had a basic level of PC awareness, these skills were overlooked and no training was provided. A lack of comprehensive training was found at company D, in that there was no information or training provided on how modules interfaced or how one person's actions affect others. After go live and after it was too late they tried to incorporate some of this training.

The final common issue is the lack of training for the implementation team. In the three cases where this was an issue, the members of the team had to learn as they went. They were not experts and the system was just as new to them as everyone else. Most learned by sitting down with the system and perhaps a consultant and working their way through it. However, a customer service manager at company C said that "although this format of training was brutal, it allowed for them to learn it well and prepared them to address issues after go live and to train other personnel in the department."   The

applications manager at company E went further saying, “training was really the biggest issue and contributing factor to the human capital aspect of the productivity dip during implementation. If they core team members do not understand the product they are implementing, there will be problems.”

Each company in this study failed to provide enough employee training, although company F came close. As a result, a lack of training had a negative effect on productivity. With an overall score of 12 in this category, the proposition is fully supported.

P_3: There is a positive correlation between implementation team empowerment and output. An appropriate level of empowerment increases output which decreases the productivity dip during implementation

The level of team empowerment was very different at each of the companies, and therefore it is not surprising that the effect on productivity was also very different. The ratings cover almost the entire possible range, spanning from 3 at company E to -4 at company D. This wide range, provided in Table 14, appears to correlate with the amount of empowerment given. Meaning, at company D there was little empowerment and productivity suffered. At company E, where the team was given the latitude they needed to get the job done, there was a positive effect on productivity. Similarly, at company F the team lead worked directly for the CEO giving them the horsepower to act as necessary.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Implementation Team Empowerment	+1	-1	-1	-4	+3	+2	12

Table 14 – Empowerment Ratings

Company A relied on the global deployment team to provide input and make recommendations on project deployment and user process readiness to deploy. Additionally, the global project team was given a tremendous amount of freedom to conduct initial user training and process modification during training and post deployment to adjust business processes to meet the business situation in a production environment. On the other hand, the functional team at company D was not empowered at all. The IT lead stated, “productivity of the project team, in getting to a solution, was devastating because of this lack of empowerment.”

In addition to the pattern of more empowerment leading to improved productivity, there were two other common factors, listed in Table 15. First, empowerment changed during the course of the implementation. At company E, where empowerment had a very high effect on productivity, the project lead initially maintained all decision making ability. However, early on it became obvious the team members needed to be empowered and they were given the latitude they needed with very positive results. At company B, the team was empowered post implementation. According to a manager at company B, “productivity would have been better if they had been empowered earlier.”

Shared Team Empowerment Factors	A	B	C	D	E	F
Team given a high degree of Freedom	X		X		X	X
Empowerment changed during Implementation		X	X		X	
Unable to implement solutions to known problems		X	X	X		

Table 15 – Shared Empowerment Factors

At company C, the situation was unique in that the ERP program director stated, "the team was too empowered and will have less power in the future." Before deciding on the COTS package they chose, the implementation team was involved in interviewing a variety of vendors to find the right solution. Other vendors promised to deliver functionality without much discussion on the customization required. When the COTS package went in, team members remembered the functionality offered by other vendors and wanted to duplicate it. However, customization was against the company philosophy of using the COTS solution "as is" to keep costs down and realize the industry best practices now and in the future. This conflict had a negative effect on productivity.

On the other hand, a customer service manager at company C who was on the implementation team felt they were only able to make changes within the latitude they had been given. She stated, "at times they could see problems, but were unable to make adjustments." This is the final common factor, when teams lacked empowerment they were unable to make changes they knew would improve the project and productivity. At company B the manager said "there were several instances where we realized a change in business practices was needed. Eventually the changes were made, but if we had been empowered we could have taken care of it earlier."

Based on the overall score of 12, this proposition is fully supported. It is very clear from the information provided that as empowerment goes up, productivity goes up and as empowerment goes down, so does productivity. It was also noted that while empowerment is good, there is a point where the team can become too empowered as seen in company C.

P_4: There is a positive correlation between expectations and output. Realistic expectations increase output which decreases the productivity dip during ERP implementation.

There is much diversity on how companies rated the expectations category, with scores ranging from -2 to +2, see Table 16. Company A had the most negative rating, and it is attributed mostly to management's expectation of the productivity dip. According to the ERP program director, "senior management thought that the plant would shut down on Friday, start back up on Monday, and there would not be any productivity dip." The top management failed to take into account the amount of complexity of the new system and processes and the huge amount of user retraining required to convert a large manufacturing facility from the old to the new system/processes. The implementation team had worked with senior management to influence productivity goals and stagger expected improvements, but admit they could have better prepared them about how drastic the productivity dip would be.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Expectations	-2	-1	-1	+2	0	-1	7

Table 16 – Expectation Ratings

At the other end is company D who scored this area with a +2. The IT lead stated, “expectations were clearly set. There were many demonstrations given regarding functionality and there were no surprises.” However, a lower level employee stated, “people thought the ERP was going to fix everything at the plant.” This leaves the researcher believing that there were efforts made to communicate expectations, but they could have done a better job. However, this is still in-line with a score of +2. Three of the other companies scored a -1 in the area of expectations, and the final company rated it as having no effect on productivity. Interestingly, company E did not feel they did a great job managing expectations, saying “the users did not get the training they should have, which would have covered expectation management.” However, they did not feel this failure had any effect on productivity. The users that were more active in the implementation knew what to expect and those that had failed to participate were caught more off guard. Additionally, management expected the productivity dip and was not surprised when it happened, although it was a bit worse than expected.

There were two common themes when testing to see if setting realistic expectations affected the productivity dip, summarized in Table 17. First, the magnitude of change was not clearly communicated. A manager at company B stated, “change discussions prepared personnel for what was coming regarding business practices, but

there could have been more depth." There was also not enough done on the expectation of the performance impact. Customers knew there were changes coming, but at a working level personnel did not realize exactly what they would be. Overall, employees expected things to be much better than they were.

Shared Expectation Factors	A	B	C	D	E	F
Poorly communicated scope of ERP	X	X	X	X	X	X
Changes not communicated throughout organization	X	X	X		X	X

Table 17 – Shared Expectation Factors

At company C, users understood the to-be processes, but they did not understand that things would be less tailored in the future state. For example, users specified they needed to notify customers of order status. They were upset when they learned the process of notifying customers required a couple more key strokes because they were using COTS software versus the old custom software. This upset some employees and productivity suffered as a result.

Second, expectations were not communicated far enough down the organizational chain. This prevented all personnel from accepting the system for what it was. The ERP program director at company A felt that "a shared objective element is critical to success. People need to feel ownership, particularly end users." This also ties into another common theme, not setting expectations early enough. Company F implemented a deployment leader program during implementation. The idea was that leaders from each business unit received information about the implementation and they would disseminate it to all of their personnel. However, this did not exactly go as planned because the

information rarely made it below the manager level. Front lines did not really know what was going on or why the changes were being made. Per the VP of business transformation, "it was basically a bunch of meetings where they asked if you had told everyone." This was not very effective.

Based on the above analysis, and an overall score of 7, this proposition is partially supported. Companies typically fail in the areas of ensuring inclusion of all employees when establishing expectations, and ensuring the scope of the project is clear. There are problems if employees do not realize how big it is, as well as if they think it will take care of all the company's issues. The companies that did a better job of managing expectations had better output and thus a less dramatic productivity dip. Company F learned a great deal about expectation management from their first implementation, and today engages employees all the way down the organization chain with readiness surveys where they ask questions such as who is their deployment leader, how do they feel about their training, and do they understand why the company is taking on the new project. The goal of each deployment today is 95% engagement, called satisfactorily engaged.

P_5: There is a positive correlation between employee recognition and output. Effective recognition increases output which decreases the productivity dip during ERP implementation.

Three of the six companies rated recognition as a +1, as seen in Table 18. There was nothing significant about the recognition, but they believed it was sufficient and had a slightly positive effect on productivity. Company F believed their recognition was satisfactory, got the job done but did not have much effect on productivity. Companies A

and D reported negative feelings from employees, affecting productivity, because of the lack of or level of recognition.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Recognition	-2	+1	+1	-3	+1	0	8

Table 18 – Recognition Ratings

At company A, the project went-live several years late and experienced a severe dip in productivity. A member of the implementation team stated, “the team felt management focused solely on the aspect of the deployment that was not successful. There were 17 modules implemented and only one failed, however the failure was colossal.” Because the implementation was deemed a failure, there was no recognition. The project team had negative feelings about the lack of recognition and still talk about it almost a year post go-live. According to the same implementation team member, “team productivity definitely declined, feeling management overlooked the scope and magnitude of what was involved.”

At Company D there was some recognition given, however it was it the form of a bonus that was much less than expected. Since expectations were not met, there were negative feelings and productivity suffered. Employees also sometimes received e-mails from higher management thanking them for their time and effort. For many this method of recognition was impersonal and did not do the job.

Recognition received varied from company to company, but there was one common type that was present at the companies who rated this factor as positive and that

was recognition in front of their peers, see Table 19. At company B, they used on-the-spot awards as well as selection as associate of the month for personnel that identified process improvements. Many personnel also received promotions for their work with the project. They also gave monetary and time-off awards.

Shared Recognition Factors	A	B	C	D	E	F
Recognition in front of Peers		X	X		X	X

Table 19 – Shared Recognition Factors

At company C, the economy kept them from giving the usual monetary award. However, they included articles in the company newsletter giving updates on the project and identifying team members by name and picture. This resulted in team members becoming the go-to people to answer questions from coworkers and helped spread the perception of them being experts.

At company E, team members received monetary awards, plaques, and recognition in the company newsletter. When the implementation happened, everyone was ready to see it up and running and considered the recognition adequate. However, most members of the implementation team felt their participation was going to be career enhancing, but it has not turned out to be. None of the module owners have to this day received a promotion. One employee was scheduled for a pay grade upgrade but lost it because they were part of the implementation team. Additionally, she still did not get it when she went back to her job after implementation. According to a business analyst at company E, there were some powerful people in upper management that did not think very highly of the implementation and they badmouthed others. There is another

implementation coming in a year or two and it is expected to be difficult to find volunteers.

Finally, at company F there were celebrations and internal awards where people could be recognized in front of their peers. There were also some parties where other business leaders came in and recognized the team's efforts. Again, the feeling was that recognition was satisfactory and got the job done with no real influence on productivity.

Recognition was a positive influence on productivity at the companies who publically recognized their implementation team and other employees key to the implementation. When public recognition was lacking, recognition had a negative effect on productivity. It is important to consider not only the recognition given, but what employees are expecting as recognition. At company D where bonuses were paid but failed to live up to expectations, productivity was hit harder than at company A where there was simply no recognition including zero bonuses. With a score of 8, this factor is partially supported.

P_6: There is a positive correlation between manning and output. Dedicated manning increases output which decreases the productivity dip during ERP implementation.

The manning area considered not only how the company staffed the implementation team, full or part-time, but also manning in other departments during the project. For example, hiring temporary or additional workers to take some of the workload off of employees as they train for the new system or as their time is split between their "normal" job and learning/helping with the new system. This proposition

maintains that having dedicated manning on the implementation team, and augmenting other personnel heavily involved in the implementation increases output and thus decreases the productivity dip during an ERP implementation.

The range of ratings, presented at Table 20, goes from a +2 to a -3, with 4 of the 6 companies giving a negative rating. The two companies who scored it positive, both with a 2, were A and E. At company A, the global business team was supposed to be dedicated to the project full-time, but because the project dragged out longer than planned they got pulled for special project about 25% of the time over the 3-year planning period. On the professional side, there was very little additional manpower brought in to reduce the workload. Local super-users were only involved in the project on a minimal level during user acceptance testing and training, deployment training and post go-live support so additional manpower was not required. Additionally, the ERP program director feels that it is difficult to bring in outsiders that do not know how the business flows through the functions. He stated, "I do not believe you can just go hire consultants and make a project successful. There is no substitute for knowing the company and the system."

	Company Rating						
Factor	A	B	C	D	E	F	Total
Manning	2	-1	-2	-2	2	-3	12

Table 20 – Manning Ratings

Company A's philosophy differed when it came to laborers and warehouse workers. During implementation it became clear they needed more workers driving forklifts and pulling inventory for assembly. Senior management essentially waved all

hiring and expense authorization processes to reduce red tape and expedite hiring of 30% more personnel. This surge was maintained after implementation and was essential to meeting demand and rebounding from the downward direction of productivity during implementation.

Company E had some team members assigned to the implementation full-time, and some participated while also holding down their "regular" job. However, people who were splitting their time were given help both from other employees and from temporary employees who were hired to pick up some of the slack for regular employees while they focused on the implementation. These temporary employees were terminated after the implementation. The team members were out of their old job for 2 years so when the project ended some did not have a job to go back to but the company found them a place somewhere else within the company.

The other four companies, all who rated this area negatively, cited similar reasons for their rating. As shown in Table 21, the most cited reason was employee attention split without assistance. This includes team members who had to also do their regular job and employees who had to pick-up the slack that team members left behind. At company B, employees were 100% dedicated to the implementation. However, when people were pulled from their jobs the work was still there. This meant that the other employees were forced to sometimes do double duty, putting a strain on them and making them resistant to also fit in training on the new system.

Shared Manning Factors	A	B	C	D	E	F
Employee Focus Split w/out Assistance	X	X	X	X		X
Budget Restrictions		X	X			X
Work left Undone		X	X			X

Table 21 – Shared Manning Factors

Similarly at company D, additional personnel were hired to replace contractors as they rolled off of the development team but there was not any augmentation for personnel in the functional areas who were splitting their time between training and day-to-day duties. The IT lead reported "a lot of angst among employees because they were supposed to be dedicating time to learning a new system, but the demand of the shop floor never went away." According to a member of the implementation team, "people were pretty upset about having to be in ERP meetings for 8 hours and then go do their normal duties." At company D, the workload was especially rough for 6 months prior to go-live.

At company F, there was not any additional manpower brought in during implementation. People worked very hard and there was too much strain on project resources. The VP of business transformation said it was not unusual for employees to work in excess of 100 hours per week for several months. He stated, "they were not staffed accordingly to cover a 24/7 operation without causing undue fatigue."

A manager at company B stated, "the organization could have done some hiring of contractors to augment the workforce during implementation but the budget was limited." This same reason for not hiring additional workers was given by company C

and F. At company C, they noted the irony of their manning situation. Several years ago they were authorized to hire additional personnel but the European country where they were implementing had very low unemployment and they could not find qualified personnel to hire. Now, unemployment is much higher but because the economy is so bad they cannot afford to hire extra personnel.

Budget restraints that kept companies from hiring additional personnel not only reduced productivity by increasing the amount of time it took to accomplish duties, it also resulted in some jobs just not getting done. At company C, the customer service manager said, “not being able to hire additional personnel had a hugely negative impact on productivity because a lot of things were left undone. When people are stretched as thin as they were, only high priority problems are going to get attention.” The ERP program director also echoed this sentiment, saying that the low priority items may stay open indefinitely as they do not have the resources to address them. According to the IT Lead at company D, “people were driven as hard as they could be, so things were done poorly resulting in poor quality.”

The manpower category had an overall score of 12, making it fully supported. Further, it is clear from the lack of X’s for company E in Table 21, that their positive rating of +2 makes sense. They assigned team members full-time to the implementation team and hired part-time employees to augment the employees left behind to carry the workload and complete the training. Conversely, company F has a check in every box. There was not any additional manpower brought in, employees were worked too hard, budget constraints were a factor and work was left undone.

P_7: There is a positive correlation between enterprise-wide communication and output. Effective communication increases output which decreases the productivity dip during ERP implementation

Communication is another area where there was a lot of diversity. Ratings were evenly split between three ratings, with two scoring -1, two scoring +1 and two scoring +3 as shown in Table 22. There were many factors given as the reason communication was good and bad, as well as a lot of overlap between the companies. At company D, the IT lead said, “more communication helps productivity by keeping people aware and focused on the right things. However, their communication was nominal.” Information was produced for executives but nothing really for employees. They had a regular project team meeting, but what was discussed was not shared outside of the room.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Communication	1	1	3	-1	3	-1	10

Table 22 – Communication Ratings

At company F, the VP of business transformation said, “if communication is not part of the solution you are not going to get good results.” It made an effort to keep employees informed of key dates, but personnel on the front lines had no idea why things were changing and this caused some problems. Company F would have been much worse without the communication it did have, but it felt it could have been done much better.

Company A had multiple communication vehicles for different points of the deployment. Prior to the actual deployment phase there were weekly status reports prepared for senior management and project sponsors showing milestones progress and issues. There were weekly deployment team meetings to review deployment plan tasks and issues and the week prior to the weekend cutover there were daily deployment status meetings. Post deployment there was a daily status update on issues for the project team and there was a senior management daily review meeting to discuss major issues and actions. However, the team did not communicate to local users because the project was delayed so many times. Initially they planned to push down communications, but the team was not sure they would ever actually deploy so they did not advertise.

Likewise, European plant locals did not believe it was ever actually coming yet they were told they could not take vacation during the heavy summer vacation time. This caused some productivity issues. Key dates were advertised as implementation got close and milestones and training dates were published. However, most communication stopped at the supervisor level and never made it down to the assembly line worker. This was considered adequate at the time, because the line worker was not directly affected. Afterwards, an implementation team member stated, “insecurity among workers affects the productivity dip and better communication could have helped reduce the insecurity.” Company B made an effort to communicate with all levels, but believes communication should have focused more on the performance of the system.

Company C communicated to all employees that the implementation was happening, where they were at in the process, and how it was going to affect them. It was also communicated to all personnel how their processes feed into other processes

within the organization. This knowledge helped personnel understand how their actions affected others and had a positive impact on productivity. When they thought they had a process where they needed it, they would bring in an employee that did that job and get their input. This identified issues they had not thought of and helped gain buy-in with employees. According to an applications manager at company E, “they realized early on that they could not keep information close-hold and started telling it like it was.” This was a key turning point and crucial to the success of their implementation, but a few people still slipped through the cracks. One example is a user that thought they were going to have to process all transactions in both systems for two weeks.

At company D, very poor meeting management techniques were used almost all of the time and continue to this day. This includes poor agendas, one way communications, too many useless and pointless slides, messages not on point, no notes or meeting minutes produced and lack of accountability for action items. One big turning point in the project is credited to communication, and happened when mentality shifted from a silo to enterprise-wide focus. Meetings became longer, but everyone started to see how functions interact with one another. Seeing the whole picture allowed people to identify where problems were likely to occur.

In addition to the issues discussed, there were several commonalities as seen in Table 23. To start with, five of the companies made sure to include outside stakeholders in communication efforts. Company C notified customers with a notice on all invoices and company F made sure customers knew how paperwork would change with the implementation. Company E prepared all customers for a productivity disruption, and even went so far as to request customer approval to ship materials two weeks in advance

so that they had safety stock to cover any issues. Most companies took them up on this offer. However where company E suffered was in applying lessons learned from previous implementations. Some members made suggestions based on what they had learned, but the project manager had his own ideas about how to proceed. Had these lessons been incorporated, several missteps could have been avoided.

Shared Communication Factors	A	B	C	D	E	F
Included stakeholders outside the company	X	X	X		X	X
Newsletters	X		X	X	X	
Training used as vehicle for communication	X	X	X			
Dedicated effort to reach every employee		X	X		X	
Emphasis on Buy-In	X	X				X

Table 23 – Shared Communication Factors

Next, many companies used in-house newsletters to get the word out. At company C, they had the local newsletter as well as a periodic newsletter from the General Manager that covered the current events. On the other hand, company D feels their newsletter was probably not very widely read. The IT lead stated, “I wrote one of the articles but never looked at any of the other ones in that issues.”

Several of the companies used training as a vehicle for communication. The biggest issue with this is that training is typically done just-in-time, or immediately before go-live which is too late to start communicating. However, if it is used to augment other communication methods, it can be very effective. In this case, all three companies

did just that. Finally, three of the companies made a dedicated effort to reach every employee. This obviously paid off, as the companies with the highest two scores did this as well as one of the middle companies.

It was noted that another aspect of communication that affected productivity in a very positive way was the presence of senior leadership. The person globally responsible for manufacturing at the plant arrived a few days after go live when it was realized productivity was suffering. Employees seeing that someone at that level cared about what was going on made a very good impression, and had they been scheduled to be on location on day one productivity may have dipped less. They also stayed around a while and helped motivate staff. The ERP Program Director at company A said, “you cannot underestimate senior management influence on productivity.”

This leads into the next common area, buy-in. Overall, company A felt there was an element of public compliance, but privately some resistance due to culture or expectation management. According to the ERP Program Director, “it is important to make people involved feel a part of the process and not like this is something that happened to them.” It is hard to get the cascading effect down to the person who uses the system every day. Human tendency is to want to be left with a legacy system they know how to use but better buy-in from all users helps ensure they are on-board. This is very hard to do. Very senior management needs to be involved and sell the message, maybe even the CEO.

Company B’s manager said that, “in hindsight, the organization believes there should have been more change management with employees and that you can never do enough.” He also offers that, “you should not take for granted how the changes will

impact your organization." Buy-in should have been addressed more and earlier in the process. They had discussions with employees where they covered key changes and what the organization would look like, and town hall meetings were held immediately prior to rollout. Company F believes that if employees understand the big picture they tend to work very hard and not even complain about it. If they feel they are part of something that has a greater purpose to the company they work for.

With an overall score of 10, this proposition is only partially supported. However, there appears to be a direct correlation between those that focused on communicating with all employees and outside stakeholders, used newsletters and incorporated the change message in training. Additionally the companies that rated communication high in regards to effect on productivity truly understand how important it is to the success of an implementation.

P_8: There is a positive correlation between social factors and output. Negative social factors decreases output which increases the productivity dip during ERP implementation.

Social factors is a broad category and captured a variety of issues, largely dependent on the type of organization. For instance, those with global operations experienced issues in dealing with different countries. All but company D had a negative experience in this area, with the scores ranged from -4 to 0 as shown in Table 24. A manger at company B stated, "there were many negative social factors at play", but he was unable to articulate exactly what these factors were. Company D rated this area as

having no impact, although the system user interviewed had several things to say about how social factors had a negative impact on productivity and are discussed below.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Social Factors	-2	-1	-4	0	-2	-2	11

Table 24 – Social Factor Ratings

Cultural issues was given as a social factor by three of the companies, see Table 25, and these are the same three that have international operations. At company A, the implementation was in a low cost region and the workers did not have as much at stake in the company or their job. According to the ERP Program Director, "workers did not care as much if the project succeed or failed because they did not have a vested interest." Workers could easily go get another job making the same money or more.

Shared Social Factors	A	B	C	D	E	F
Cultural Issues	X		X		X	
Pressure from Management				X		
Incentive Pay Systems				X		
Personnel Conflict					X	
Corporate Structure						X

Table 25 – Shared Social Factors

Company C dealt with five countries during their implementation, which in this case meant dealing with five cultures and five different languages. The attitude they got

from France in particular was "you Americans cannot come in here and tell us how to do our job." This made it difficult to train them or convince them of the system benefits. Additionally, language barriers were an issue at times because items got misinterpreted and blow ups happened. At company E, the issue was simply that they had outsourced technical support to India and personnel had trouble understanding the technicians.

At company D, there was pressure from management to go-live, even if they did not think the company was ready. A go-live date was set early on and there was nothing that could happen to push it back. Of course, issues did come up and people had to bend over backwards to keep the project on schedule for implementation. The core implementation team put a lot of pressure on local teams to sign off on the implementation, even though they knew the company was not ready. According to a system user at company D, "this resulted in a lot of negative attitudes from people and comments such as I don't care, they're going to make me do it anyways."

Also an issue at company D was that blue collar workers were paid via an incentive system based on the number of parts they made. A key component of the new ERP system was to capture work in progress and provide data on their processes, which required additional inputs in the computer as work was completed. The incentive workers quickly learned that putting data in the computer did not contribute to how much they made, and may in fact result in them losing money because of the time spent inputting data. For this reason, they stopped using the system and continued about their day as before.

Personnel conflict was given as a social factor at company E, and it was a problem in several forms. First, there were two team members who traveled to the site of

the implementation, away from their family each week. All other team members were local. The travelers tended to do work in the evening after dinner as they were away from the family and had few other options. This caused the locals to get upset because they did not want to work the same long hours. Another personnel conflict occurred with two of the team members who failed to participate in any event and did the bare minimum each day. It was a problem because the team failed to be as cohesive as they could have been because two people refused to participate. Three consultants did not get along with their company E counterpart and had to be replaced and one consultant had to be replaced because they were passive aggressive, never speaking up to voice her ideas but then implementing what she thought versus what was agreed upon.

Finally, corporate structure was cited by company F as being a social factor that affected its implementation. The company was fractured in how it was structured and basically broken into four groups with four presidents. According to the VP of business Transformation, "the projects team felt they were serving multiple masters causing stress and reducing productivity." This company has since restructured and resolved the issue.

There was a great deal of variety with the issues uncovered in the social factors category. Each company cited a different issue and there was very little overlap. With an overall score of 11, this proposition is partially supported.

P_9: There is a negative correlation between workarounds and output. Workarounds decrease output which increases the productivity dip during ERP implementation.

Although five out of six companies indicated there was an effect on productivity because of workarounds, three of them gave a positive rating. The range of ratings, shown in Table 26, was -2 to +1, showing that even when there was affect on productivity, it was minimal. Company E scored it the worst, with a -2.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Workarounds	1	1	1	0	-2	-1	6

Table 26 – Workaround Ratings

Prior to their implementation company E had to extract data into one of 75 databases to analyze and generate reports. During the implementation these databases were analyzed and those considered critical were maintained or incorporated in the new system, but 80% were cut. According to an applications manager, "employees were so wrapped up in the Access databases that after implementation they still took data and put it into Access even though it was no longer required." It took a greater understanding of how to get and use data in the new system to get past this.

This issue of wanting to keep doing things the old way was not unique to company E, and was given as a reason for workarounds by a total of 4 companies as noted in Table 27. At company B, implementation of the new system changed employee responsibilities. Before implementation, an employee would be responsible for an entire process for a few customers, whereas after they were responsible for a small part of the process for many customers. However, employees continued to try and work an entire

process after implementation. A company B manager said, “this led to multiple personnel completing the same task and productivity for both parties was reduced.” Additionally, personnel would go to old contacts for information even though they were no longer the point person for that information. This led to bad information being given and subsequent bad decisions based on the bad information.

Shared Workaround Factors	A	B	C	D	E	F
Wanted to Keep Doing Work the Old Way		X		X	X	X
Sanctioned by Management	X	X	X			X
Workarounds in-place Before Go-Live	X					

Table 27 – Shared Workaround Factors

At company D, workarounds were minimal and thus the reason for a neutral score. However, some employees went into the old system to retrieve data. Company F’s workarounds were at another level. Because of how the company was organized, there were four ways to do everything meaning there were basically three workarounds for everything. This put a great deal of strain on the help desk during implementation. They not only had an increase in workload because of the implementation, but when a call came in they had to determine which group it was from, figure out what process was an issue and then remember which process that group was supposed to be following.

The bigger issue for company F is that these workarounds were sanctioned by management. Instead of making the four groups come together and decide on one best way, each was allowed to do it differently. According to the VP of Business Transformation, “disparate business processes made support difficult and absolutely

created a productivity dip specifically in terms of the IT team being able to respond to problems as they came forward on a daily basis." On the positive side, non-sanctioned workarounds were not possible because once the new system came up the old one was gone. To do their job employees had to use the new system.

Three other companies had management sanctioned workarounds, however these all led to positive gains. At company B, they had a major positive workaround where a legacy system became a bolt-on to the ERP system after the new system did not function as necessary in a particular function. This same type of workaround was done at company C, where they were unable to implement the scheduling module. To accomplish this critical process they used Microsoft Excel. Eventually they plan to implement the module, but the workaround is effective until that happens. Finally is company A, whose implementation team built a major workaround to generate critical data it could not pull from the new system. Before the workaround their productivity was dropping drastically. They were unable to get a clear picture of material availability which resulted in major problems producing units. The workaround was able to get productivity moving in the right direction.

Company A also experienced an unexpected issue with non-sanctioned workarounds at the warehouse that were in-place before implementation. One ERP team member said, "no one had done any work on the material management side to validate that the processes, people or material handling equipment was at a state to handle an increase in production." When implementation happened, and demand increased all the workaround fell apart and productivity took a huge dive. Subsequently, additional

equipment and personnel were procured to get productivity moving in the positive direction again.

Given an overall score of 6, this proposition is partially supported. It is clear from the findings that workarounds can be both positive and negative depending on the type. In most cases, if workarounds are sanctioned by management they will have a positive effect on productivity. If they in the form of personnel trying to do things the old way, it often results in duplication of effort with is a negative drain on productivity. Finally, it is imperative to look for all current workarounds before go-live so that they can be factored into the grand plan.

P_{10}: There is a negative correlation between resistance and output. Resistance decreases output which increases the productivity dip during ERP implementation.

All six companies indicated resistance had very little effect on productivity, scoring this category with only a -1 or 0. As shown in Table 28, four companies gave it a -1 and two gave it a 0. Both company E and F stated that there was very little resistance during implementation outside of the typical thinking that the old way was easier. However, once people started using the new system and realized how much easier it was to do their job they got on board. Company E was very sensitive to making everyone equally happy with the new system, believing that everyone getting 80% of their wants was better than some getting 60% and some getting 100%. They believe this philosophy helped with acceptance, and avoided resistance.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Resistance	-1	-1	-1	-1	0	0	4

Table 28 – Resistance Ratings

The IT lead at company D had an interesting comment. He stated, “people will always take the shortest path.” This was in regard to the new system requirement for employees to update status as they did their job. Employees resisted this because there were no repercussions if they did not do it. They were paid based on the number of pieces they produced, and updating a computer only slowed them down. This type of resistance, taking the shortest path, meant their data is not as useful as it could be. Also, the implementation date was set in stone which made you get things done, but also resulted in some poor products going in. This led to resistance to the new system.

Also at company D, employees were quick to find fault with the new system and use it as a reason that the old system was better. One example was when an insignificant piece of data was left off of the pay statement and there was a big uprising over it. Actual pay was not affected and the data could be found elsewhere but it was simply a reason to complain. This theme of looking for a reason to complain was seen in other companies as well, as indicated in Table 29.

Shared Resistance Factors	A	B	C	D	E	F
Looked for Fault with System		X	X	X		
Made Resistant Employees part of Implementation			X			
Lack of Ownership	X					

Table 29 – Shared Resistance Factors

One site at company C had experienced several failed implementations and so they had a horrible attitude. They shared their feelings with employees at a site involved in the current implementation, poisoned them on the system and started looking for every reason to reject go-live. Per the ERP program director, "company professionals would go and demonstrate the new system capabilities but the local employees did not believe what they were being told." In fact, the site insisted on bringing in an Oracle consultant to explain the new processes again, where they were told the exact same thing. The ERP program director stated that, "jumping through so many extra hoops plus the expense of bringing in consultants to repeat information, resulted in a hugely negative impact on productivity." On the other hand, company C had a smart method of mitigating potential problems with resistance by bringing in those employees that could potentially be a problem. They would ask them their opinion on the new planned process, based on their expertise.

Employees at company B did not understand why they even needed a new system and employees still believe the old system was better. They continually look for problems with the system instead of looking for ways to make it work. According to a manager at company B, "the message that there is no plan B needed to be communicated

better.” This may have helped get employees on board. Instead, they felt that if the new system failed they would just revert back to the old system and tried to help this along.

At company A, resistance was in the form of failure to accept the new system. In some cases people stood around indicating, they had no idea on how to resolve problems. There was also a tendency of line supervisors to come into management meetings and state the system did not work or function as anticipated. When asked what action they took to resolve the problem or report the problem, the standard answer was they had done nothing as they were not sure if the system was functioning as intended or not. Senior management constantly emphasized that local management, including supervisors, were responsible for operations and the management team owned all process and system issues until the project team formally resolved them.

In some cases resistance resulted in system issues not being reported in a timely manner or a slowdown in material movement and building product. Lack of timely information or training issues in knowing how to do system functions caused productivity losses in just trying to perform the same day-to-day transactions they were familiar with in the old systems. An ERP team member stated, “supervisors need to own processes, and see problems as their own versus shifting blame.” However, 6-months post deployment this was still occurring.

Although there was a lot of good information gathered in this area, the overall score of 4 means the proposition is not supported. It is however obvious that resistance is not a good thing and there is no evidence it would improve output. Although the impact was very minimal, it cannot hurt companies to address the issue and keep it from becoming a larger factor, likely through communication and training channels.

P_{11}: There is a negative correlation between turnover and output. Turnover decreases output which increases the productivity dip during ERP implementation.

Turnover was not a factor for 4 of the 6 companies as seen in Table 30. However, the four companies who scored the area as not having any impact still had issues in this area. For example, company A had a high degree of employee turnover due to a large number of international companies hiring English-speaking employees. There was a 35% turnover rate in production assembly associates and a 40% plus turnover rate in warehouse material handling associates. There were many threats made that if the system being deployed was not very user friendly and easy to operate for warehouse associates, they would simply leave and get a job elsewhere. In spite of these threats, company A is not aware of anyone actually leaving.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Turnover	0	0	-2	0	0	3	5

Table 30 – Turnover Ratings

There was also turnover on the global implementation team. They lost two key global business process owners in the production scheduling and manufacturing/material management area 8 months prior to the final system deployment. Losing these two key global process owners meant training three new associates to replace the associates who left and trying to get them up to speed while trying to deploy the new systems and

processes. The IT team was forced to step in and actually do the user training in many areas to cover for the lost user expertise.

Company B saw an increase in unplanned retirements likely attributed to the new system, however since these employees did not yet know the new way, there was no loss to productivity. About three months into implementation planning, company E switched consultants because it felt the current ones were not what it needed. This new group worked out very well, but a few months prior to go live funding was getting tight so this new group was also let go and duties were absorbed by the in-house consultants. This caused some issues and probably impacted productivity.

For the two companies who gave a score other than 0, it was a somewhat significant factor. At company C, there was only one team member that understood the scheduling module. When he left during implementation, there was no one to pick up where he left off and subsequently that module was not implemented. A workaround was used, and to this day the gap had not been filled and subsequent implementations are also deficient in this area. On the positive side, employees with performance issues were magnified after implementation, leading to their termination which helped productivity.

Company F had zero turnover during the implementation. They had a dedicated, hardcore group with a high sense of urgency to succeed. It also did not hurt that there was a bonus program based on the success of the project. According to the VP of business transformation, “the fact that the project team was consistent and there were not people coming in and going out was very important to their success.”

Given the very low overall score of 5, the proposition is not supported. Here again though, lessons can be learned. Management needs to pay attention to the expertise

needed on the implementation team and ensure there are qualified personnel to fill holes if necessary. Additionally, companies probably do not need to worry about a mass exodus of the general employee population during an implementation, even if they threaten to leave.

P_{12}: There is a negative correlation between sabotage and output. Sabotage decreases output which increases the productivity dip during ERP implementation

Sabotage was clearly not an issues for any of the companies interviewed, with all six rating this factor with a 0, see Table 31. The closest anyone got to sabotage was at company A, when warehouse workers would hang out in the far corners so that they could not be found when needed. At least this is the speculated reason for doing this. Along the same lines, at company C employees would drag their feet, resulting in delays to the implementation. However, there was zero effect on output and subsequently productivity, leaving this proposition not supported.

	Company Rating						
Factor	A	B	C	D	E	F	Total
Sabotage	0	0	0	0	0	0	0

Table 31 – Sabotage Ratings

Human Capital Priority Analysis

Now that each of the factors have been explored individually, it is necessary to look at their importance overall. Table 32 provides a look at all of the factors, presented in order from most to least significant, and labels each proposition as fully, partially or

not supported. Implementation team composition scored the highest, making it both fully supported and the most important human capital factor in the productivity dip during ERP implementation. This was followed by training, team empowerment and manning, each scoring a total of 12 points and fully supported.

		Company Rating							
#	Factor	A	B	C	D	E	F	Total	Proposition
1	Implementation Team Composition	4	1	2	4	3	1	15	Fully Supported
2	Training	-1	-2	-2	-3	-4	0	12	Fully Supported
3	Team Empowerment	1	-1	-1	-4	3	2	12	Fully Supported
4	Manning	2	-1	-2	-2	2	-3	12	Fully Supported
5	Social Factors	-2	-1	-4	0	-2	-2	11	Partially Supported
6	Communication	1	1	3	-1	3	-1	10	Partially Supported
7	Recognition	-2	1	1	-3	1	0	8	Partially Supported
8	Expectations	-2	-1	-1	2	0	-1	7	Partially Supported
9	Workarounds	1	1	1	0	-2	-1	6	Partially Supported
10	Turnover	0	0	-2	0	0	3	5	Not Supported
11	Resistance	-1	-1	-1	-1	0	0	4	Not Supported
12	Sabotage	0	0	0	0	0	0	0	Not Supported

Table 32 – Human Capital Factor Ratings Summary

There were five factors that came in as partially supported, followed by three that are not supported. At the bottom of the list is sabotage with 0 points. This area was scored 0 by all six companies, none of which experienced any form of sabotage during their implementation.   This gives companies a rank ordered list of the human capital factors and their effect on the productivity dip during an ERP implementation.

Summary

This chapter presented the results from the twelve interviews at the six companies studied. Further, the chapter presented evidence to either support or dispute each of the twelve propositions. This was done by first examining how long and deep each company's productivity dip was, followed by how much of the dip the company felt was due to human capital issues. Next, the majority of this chapter was spent on examining each factor across each company, and presented common issues that were either a positive or negative influence on productivity during ERP implementation. Finally, the twelve factors were looked at as a complete set to determine a rank ordered listing from most to least important. The next chapter takes these findings and applies them to answer the overall research question and provides recommendations for the USAF in implementing ECSS.

Chapter V. Conclusion

Overview

Chapter five provides the researcher's conclusions on what to expect regarding depth and duration of the productivity dip during an ERP implementation. Additionally, based on the case study analysis, recommendations are provided for how the USAF can best manage human capital factors during the ECSS implementation. The chapter concludes with an explanation of assumptions and limitations of the research followed by lessons learned and potential areas for further research.

General Implication of Findings

Any company implementing a large scale process change such as an ERP, will experience a dip in productivity during implementation. The duration of the dip is difficult to articulate, but findings indicate that it will be at least 30 days long and can last for greater than three years. Depth is even more difficult to define, and the best this researcher could do was categorize it as average to significant. The depth is based on severity of impact on productivity, which varies by company. An organization should strive to identify productivity measurements prior to implementation and track them before and after go-live so that they can truly articulate not only the productivity dip, but the gains they later receive from the new system.

The dip is attributable to factors such as software fit, timing and various human capital factors. This study found that on average, approximately 50% of the productivity dip is a result of human capital factors. If it is a plain and straight forward implementation using COTS software, the human capital percentage is likely higher than

if it is highly customized. All factors must be considered, but by addressing just the human capital piece companies stand to substantially reduce the depth and duration of the dip.

In order for a company to address the human capital factor, they need to understand the various components, as well as understand which factors have the biggest impact. The research identified nine factors to consider when developing a plan to address the human capital influence and thus mitigate the dip. At the top of the list, and representing fully supported propositions, are implementation team composition, followed by training, team empowerment and manning each of which are equally weighted.

Implementation team composition includes ensuring cross-functional team members who are assigned solely to implementation. The training aspect is extremely important and suggests training should be with a live trainer, cover new technology as well as new business practices, and comprehension should be tested if the material is complex. Empowerment simply addresses that the team should be able to make and implement decisions, applicable to their task, to keep the project moving. Manning suggests that personnel involved in the implementation effort or who need to attend training, should be augmented by additional personnel so that they are not overworked, leaving work undone or done poorly.

A level down, coming from partially supported propositions, are social factors, communication, recognition, expectations and workarounds. Social factors cover a lot of ground and include everything from cultural differences for companies with operations overseas, to pressure among employees in the organization. Communication has a wide

impact and can actually affect several of the other categories. Recognition and expectations involve taking care of the employees by identifying their contribution publically and ensuring people have a realistic idea of what to expect during and after implementation. Workarounds can have a very positive or negative impact on productivity, depending on the driver of the workaround and whether or not it is sanctioned by management. Each of these nine factors are described in greater detail in chapter four.

Recommendations for ECSS

Based on the research findings, the recommendations listed in Table 33 are suggested for consideration by personnel responsible for the ECSS implementation in the area of productivity measurements, implementation dip expectations and management of human capital factors.

Area	Recommendation
Productivity Measurement	1. Clearly define productivity measurements important to the USAF
	2. Start measuring or collecting productivity data now
Productivity Dip Expectations	1. Plan for a dip in productivity
	2. Prepare management for dip
Human Capital Factors	1. Place core cross-functional implementation team members on-site during implementation, who can transfer knowledge to local users
	2. Comprehensive, hands-on training with a live instructor
	3. Empower implementation team to modify processes and implement solutions
	4. Provide manning assistance to offset implementation requirements
	5. Plan for social factors such as culture, personnel and incentive differences
	6. Communicate with all levels about what is happening, when and why
	7. Provide recognition in front of peers
	8. Communicate realistic expectations throughout the organization
	9. Avoid workarounds unless sanctioned by management to fill a gap with ECSS

Table 33 – ECSS Recommendations

Productivity Measurement

1. Clearly define productivity measurements that are important to the USAF.

It is important to have metrics in place that allow the USAF to identify gains or losses in productivity. Without them, there is no concrete way to know how productivity is

affected. The measurements should be defined carefully, as to avoid driving the wrong behaviors. Start with overarching goals and then break them down into measurable pieces, ensuring there is no conflict between measurements and that they will not result in unintended consequences. For example, if the goal is to improve command and control, measurements that help achieve this are important.

2. Start measuring or collecting data now.

After determining which productivity measurements are important, the USAF needs to ensure they are tracking the measurements now. If it is not possible to calculate measurements now, they should at least collect the raw data now. It is important that these measurements are watched during the implementation so that if they start to take a dive, immediate action can be taken to mitigate it. Otherwise, negative effects may go unidentified until their magnitude is so great that there is a very negative effect on the USAF. It is also important to start measuring now so that there is a well established baseline on which to document gains in productivity after the initial dip. The USAF is investing a great deal of money in this implementation, and having numbers that document improvements in productivity will help justify the funds expended.

Productivity Dip Expectations

1. Plan for a dip in productivity.

It is unrealistic to expect there will not be a dip in productivity when ECSS is implemented. As such, the USAF should plan for it and take steps to mitigate the impact.

This can be done by scheduling go-live when the operations tempo is at its lowest point. This applies to the USAF, and not just the base where ECSS is going live. For example, if Maxwell AFB is the first go-live site, implementation should be scheduled when Maxwell doesn't have a surge in deployments, inspection or other significant event. Additionally, whoever they support needs to also be considered. If things are slow at Maxwell but customers supported are surging, it is not a good time to implement.

2. Prepare management for dip.

One of the issues companies in this study had was that management expected to turn off the old systems on Friday, start-up the new system on Monday and for productivity to take off immediately. When this did not happen, senior management overreacted or considered the implementation a failure. Considering the magnitude of ECSS, there will be a dip and it would be unfortunate for leadership to dismiss the years of hard work spent implementing it because they do not believe there should be one. To prevent this, senior leadership needs to be adequately informed of what to expect and understand why to expect it.

This researcher would recommend planning for a duration of at least 90 days, probably longer, and a significant depth. This worst case timeframe approach is suggested as companies typically experience more of a dip then they planned for. Additionally, company B may be the most similar to the USAF in terms of type of employees and magnitude of implementation. As noted in section four, they are 3 years post implementation and have still not recovered fully from the dip. The USAF is

unlikely to implement if they are told there will be a 3-year dip, but this knowledge may help them accept a dip of 90 days.

Human Capital Aspect of the Productivity Dip

The research findings suggest human capital accounts for an average of about 50% of the productivity dip during an ERP implementation. While the USAF needs to address all aspects of the dip in order to effectively minimize its impact, this research provides some insight on how to address the human capital aspect by breaking it down into more tangible components. Twelve components were evaluated for a correlation with output, which when increased improves productivity. Results indicate a correlation is fully supported in four factors, partially supported in five factors, and not supported for the remaining three. Next are recommendations on how to address the fully and partially supported factors, presented in order of most to least important.

1. Core cross-functional implementation team members on-site at implementation, who transfer knowledge to local users.

The composition of the implementation team was the human capital factor with the greatest impact on productivity in the companies studied. In order for the USAF to capitalize on this aspect, there are several steps it can take. First, there should be a core implementation team, dedicated to this project and responsible for its success. The personnel on the team should be composed of USAF personnel, military and civilian, in addition to contractors. Ideally, team members would have some previous experience implementing an ERP to draw from, but at a minimum should represent all functional

areas affected by the implementation. It may be that functional expertise comes from the USAF personnel and contractors bring the ERP expertise and experience.

When implementation occurs, the implementation team, or at least a representative portion of it, should travel to the implementation site. It is important that the team be present during go-live to quickly fix issues that come up, as well as to put employees at ease. Knowing an expert is immediately available to help out if there is a problem can go a long way to ease employee anxiety about the new system. Additionally, the team needs to transfer their expert knowledge to local users so that after they are gone, there is still expertise immediately available. This not only helps local users take ownership, but also sets them up for success in trouble-shooting future problems.

2. Comprehensive, hands-on training with a live instructor.

Training was a negative factor for each of the companies interviewed. Several had put great emphasis on training, but it needs to be better than average or it will not be good enough. The USAF should plan a very robust training effort that reaches all personnel affected by ECSS. Most importantly, the training needs to be conducted with a live instructor shortly before go-live. If it is left to computer based training, or training where employees go into a dummy system on their own to look around, it will become a second, third or worse priority and it will not be given the attention required. Additionally, training should give employees who will use the system a chance to go in and enter mock data and navigate through screen as they will after go-live. If the information is of a technical or complicated nature, employees should be tested after training to ensure learning occurred. The timing is important because if it is done too early, employees will

lose the comfort level they got while in training and if done too late, it means it is after implementation and productivity is declining each day employees do not know how to use the system.

The personnel who do the training should have basic trainer skills, know the tool they are training, in this case ORACLE, and know the USAF environment and how the system will operate in practice. If trainers do not possess all these skills, the training may not be as effective as it otherwise would be. The training needs to be comprehensive in that it needs to cover not only how to use the new system, but also any business practices that will change after implementation. Finally, it is important not to assume all employees have basic computer skills if they are not already required. If an employee does not know how to log onto the system, they are not going to be able to use it. If this is an issue, a little additional training up front could prevent large problems down the line.

3. Implementation team empowered to modify processes and implement solutions.

The USAF should empower the implementation team to make decisions and modify processes as necessary during the course of the project. Companies in the study that did not empower their teams either suffered a very negative effect on productivity or adjusted during the course of the project to give them the necessary freedom. If the team is forced to run every decision up the organizational chain of command, a great deal of time will be wasted which will translate into less output and lower productivity. The only caveat is to ensure that the team is not given too much empowerment. They still need to be accountable to senior management and must be given clear project objectives so that

decisions are based on the overall goals and course changes that are mapped to the objectives.

4. Manning assistance to offset implementation requirements.

There is an additional workload that accompanies an implementation such as ECSS. This researcher recommends bringing in additional manpower to offset this additional workload. It may be in the form of temporary workers, consultants or new hires. The extra workload is felt in several areas. If the implementation team is not assigned full-time, they are pulled between two often demanding jobs. Assistance with their "normal" duties can make a big difference. On the flip side, if they are pulled from a job to work on the implementation full-time, they leave a hole. Backfilling that position versus expecting other employees to pick up the slack will have a positive impact on productivity.

When employees are pulled for training the same situation exists with the work of employees in training and the workload of those left behind. The magnitude of this issue varies depending on the workload at the time, as well as the duration of the training. If an employee is out for one day, it may not be an issue. However, if there are many employees pulled from the worksite for weeks at a time, it can be a serious issue. Failing to augment the workforce will likely result in work left undone or done poorly, which certainly has a negative effect on productivity. This researcher realizes the budget is an issue and that it could prevent this recommendation from becoming reality.

5. Plan for social factors such as culture, personnel and incentive differences.

The USAF needs to assess its population and determine if there are cultural differences. Here, cultural differences may exist when comparing white versus blue collar workers. If the USAF employs personnel who feel they do not have a stake in the organization they will not care if the implementation succeeds. This is not to say that blue collar workers do not have a stake, it is just an area that deserves some attention to determine whether or not it is an issues. If this situation exists, the USAF should take steps and give them a vested interest in the project succeeding.

With a project this big there are many people working together to make it succeed. Managers need to be mindful of personality conflicts and should watch for any that may get in the way of the project. If conflicts cannot be resolved, action should be taken quickly to resolve them and move on. Otherwise, issues fester and productivity suffers.

A final issue deals with employee incentives. Specifically, civilian employees who are under NSPS have specific objectives which they are rated against and subsequently paid against. Civilian personnel should be involved in the process so that they can help facilitate changes to these objectives so employees are motivated to reach the same objectives as the USAF regarding ECSS. This pertains not only to implementation, but also to training and use after go-live.

6. Communicate with all levels about what is happening, when and why.

Communication is a very powerful tool that the USAF can use to get buy-in from employees, which has a very positive effect on productivity. More specifically, all levels of employees should be provided information informing them of what ECSS is, what the

milestones are, when the system is scheduled to go-live, why the system is necessary and how it will affect them. This last point is important because if employees understand what it means to them and if they see the big picture, they are more likely to buy-in and contribute to making the project a success. Outside of the employees affected by the actual ECSS system, other stakeholders should be informed of what is happening.

There are several possible vehicles for getting the word out, but most often used by the companies in the study is an employee newsletter. Of course this is only effective if employees read the newsletter. In the USAF, I believe this could be a challenge. The Air Force Portal offers another venue for putting information out for others to read, but it requires employees seek it out versus pushing it out to them. An innovative method used by company F that could work well is pushing out screen savers with project updates.

Although waiting until the training is too late to start communicating, it is a great venue to communicate in more detail and get buy-in from those who are not on board yet. Perhaps the most influential method of communicating and getting buy-in is having senior leadership be the one sending the message. Mr. Grover Dunn has already put his name out on several communications that stress the importance of the project. At the Wing level, the Wing Commander should also push the message so that people have someone locally in a position of power to hear it from. Everyone may not know Mr. Dunn.

7. Recognition in front of peers.

Personnel typically invest a lot of time and effort implementing an ERP. When it is all over, they feel a sense of pride for the project and want to have their work

acknowledged by others. Recognition does not have to be extravagant, but should meet expectations. For example, if a bonus is promised it should be a bonus worth getting. If it is only going to be $200, perhaps it is better not to give one. There are many aspects to ECSS and if implementation is an overall success, with the exception of a failure in one area, recognition should still be given to those responsible for making the success happen. This of course assumes the failure is not catastrophic and that the issue could not have been anticipated.

Regarding the format for recognition, it should be given in front of peers. This was the number one issue across companies in the study. When team members were recognized in private, or not at all, productivity from the team members suffered for a long time post implementation. Additionally, it made them resistant to embrace future projects.

8. Communicate realistic expectations throughout the organization.

As discussed previously, realistic expectations must be communicated to senior management about the productivity dip associated with implementation of ECSS. Additionally, all employees need to clearly understand what the system will and will not do. For example, they need to understand that it will reduce the number of systems and that it will make accountability easier, however it will not magically make inventory levels 100%.

Employees also need to be told what it means to implement a COTS system. Highly customized reports generated by legacy systems will not exist, but they will be able to access the same data. There may be an extra step required to input information, but

overall the process is streamlined. If their jobs are going to change significantly, great effort needs to be made to ensure the employee understand this and again, buy-in is very important to keeping the negative effect on productivity minimized.

9. Avoid workarounds unless sanctioned by management to fill a gap with ECSS.

Workarounds typically occur because employees want to keep doing their job the way it was done before implementation. This is a problem because it often results in duplication of effort and therefore a reduction in productivity. The USAF can minimize workarounds for this reason by doing a good job of educating employees about the new processes and why the old processes are being changed. The best way to do this is through the training and communication methods discussed above.

During the implementation process, it is important to identify any workarounds that may currently be in place. This is easier with management sanctioned items, but it may be difficult to find the local workarounds done under the radar. However, if these are not identified now, they may cause big problems in the future. The best way to identify these is to talk with the employees doing the job, not assume it is done the same way at every location and again, get buy-in by involving the employees in defining the process.

Finally, the USAF needs to keep an open mind about workarounds that may have a positive effect on productivity. It may be necessary to implement a workaround to supplement ECSS or to perform the function having trouble if there are problems when the system goes-live. This could be temporary or turn into a bolt-on to ECSS. However, if it can help in the short-term, and is sanctioned by management, it can be positive for productivity and prevent the dip from going deeper.

Assumptions/Limitations of Research

As stated early on, a major assumption of this research was that findings from civilian companies were applicable to the USAF. Additionally, the magnitude of ECSS is much greater than that of any of the companies interviewed. However, a variety of companies were chosen for this study and it is this researcher's belief that these experiences are applicable to the USAF. The second assumption was that by increasing output, you increase overall productivity. This then lead to a major limitation.

It was very difficult to capture the productivity dip given that most companies did not measure productivity before and after implementation, if at all. Additionally, when measurements were available, the factors measured varied. Most of the conclusions gleamed from this study is based on anecdotal information as hard facts were not available. However, given that this was a multiple case study the real value comes more from the comments of the interviewees about why they thought productivity increased or decreased based on the human capital factors. The final limitation is that this study focused only on human capital factors, although there are many other factors that contribute to the dip in productivity during an ERP implementation.

Lessons Learned and Areas for Further Study

The scope of this project may have been too broad, and as a result the findings too broad. For example, during the interviews some answers could not be explored more fully due to time constraints. Perhaps it would have been better to focus only on defining the productivity dip and tailor interviews to questions about measurements and performance. The other option would have been to focus only on the human capital

aspect of the dip and forgo discussions about the depth and duration of the dip. Additionally, the researcher is not convinced there was any real value to interviewing two personnel from each organization to get different perspectives. Based on the similarity of the results, this time may have been better spent interviewing six different companies and getting a broader perspective.

Given that this research focused only on the human capital aspect of the productivity dip, additional research could be done to look at all of the other factors. Only by addressing every factor can a company hope to truly minimize the dip. Another avenue of research could focus on more specifically on what companies have done since implementation. Looking at only companies that implemented more than five years ago may paint a better picture of how much impact an implementation can have. As noted in this research, it can take many years to fully realize the benefits of an ERP or to realize success.

Appendix A: List of Abbreviations and Acronyms

This listing provides a quick reference for the various abbreviations and acronyms used throughout the study. The paper initially spells all terms out before using the abbreviated form.

Abbreviation		Description
AFB	-	Air Force Base
CEO	-	Chief Executive Officer
CIO	-	Chief Information Officer
COTS	-	Commercial Off The Shelf
DoD	-	Department of Defense
ERP	-	Enterprise Resource Planning
ECSS	-	Expeditionary Combat Support System
IT	-	Information Technology
KPI	-	Key Performance Indicator
ODBC	-	Open Database Connectivity
PC	-	Personal Computer
USAF	-	United States Air Force
VP	-	Vice President

Appendix B: Introduction and Research Summary Letters

Introduction Letter

(Adapted from: Ellram, 1996)

Date

Dear ,

Thank you for talking on the phone with me today. I am really looking forward to my visit to _____ on _____. I truly appreciate your time and your willingness to host my visit. I plan to arrive at your facility at approximately ________ as you suggested.

I have included a brief research summary as well as copies of the interview guides. These documents are guides for the overall interview process, and cover the host of topics I would like to discuss. Although the guide may seem long, I fully intend to take up no more than 1 ½ hours conducting the primary interview. The implementation experience for Enterprise Resource Planning (ERP) systems varies dramatically from company to company, and understanding how human resource factors affected your company's productivity during the implementation process is important to my research.

If you could send in advance any general or specific information about human resource issues during implementation or productivity measurement data from before implementation through today, I would greatly appreciate this courtesy. Having this information would help me better prepare for our visit.

Thanks again! Please call me at _____________ or email me at _______________ if you have any questions or concerns.

Sincerely,

Research Summary Letter

Research Summary

Focus of Study

The focus of this research is to identify where to focus efforts in managing human capital to minimize productivity decline during the United States Air Force, Enterprise Resource Planning (ERP) system implementation. The study uses a two-part research approach by first identifying critical human capital factors, and then testing these factors against actual ERP implementations, like your company's, using case study research. Understanding _________'s productivity changes during ERP implementation, as well as your strategies and experiences with human capital relating to the implementation is a critical portion of this second part of this research.

Purposes

1. Identify and prioritize critical human capital success factors for implementing an Enterprise Resource Planning (ERP) system.

2. Define productivity changes experienced during all phases of ERP implementation, including duration and depth of productivity dip following implementation.

3. Provide human capital management recommendations to minimize productivity dip duration and depth in future ERP implementations based on the knowledge gained about human capital factors.

Benefits to Participating Companies

Participating companies will be given in-depth results from the research, including their company's individual case study write-up and the overall research results. These results should lead to greater visibility of the productivity dip depth and duration following ERP implementation as well as insight to the human factors that influenced it. If requested, I will compile a report comparing the results of your organization to the other participating organizations. This comparison may enable you to determine what methods to use when implementing new (or expanding existing) ERP systems or when performing some other large-scale transformation process in the future.

Privacy/Confidentiality

To increase the validity of the study and the acceptance of the findings, the study would like to identify your company as a participant in publications generated through this research, unless you specify that your company wishes to remain anonymous. In either event, in order to ensure accuracy, transcripts of data collected during the

interviews will be provided to the interview respondents so that necessary corrections or clarifications can be made.

Time Commitment/Time Frame

Case study research involves interviews with key respondents within organizations. As part of the research, I would like to interview the following type of person:

Number of Interviews	Individual	Time Involved	Nature of Questions
1	Manager knowledgeable about organizational metrics, productivity measurement history and human capital issues or successes with implementation.	60-90 Minutes	• Productivity measurements • Changes in productivity • Human Capital Strategies (communication, training, manning, etc…) • Human Capital Issues (Sabotage, resistance, etc…)
1	Middle or lower level employee who was employed during the implementation and who uses the ERP system on a daily basis.	45-60 Minutes	• Resistance to new system • Workarounds • Sabotage • Social Factors (peer pressure, etc…)

The interviews will be face-to-face, on-site interviews. Follow-up questions, if necessary, will be handled via phone or e-mail.

My goal is to complete the data collection phase of this research by _________ and to submit the findings of my research to all participating organizations no later than ______________.

Appendix C: Interview Guides

Primary Interview Guide

Human Capital Influences on Productivity During ERP Implementation

Primary Interview Guide

Background Information:

Name____
Job Title ______________________________Years with Company ___________
Company Name____
Industry____
Total # of: Company Employees _______

1. When did your company begin taking steps to implement its Enterprise Resource Planning (ERP) system?

2. How long did the ERP implementation take – from initial ERP concepts to "going-live"?

3. What was the actual "go-live" date?

4. What was the implementation strategy? (select one)

- ❑ Slow phased-in implementation approach supported by organizational learning
- ❑ After a pilot project implementing one module, all other modules followed in step
- ❑ Big Bang implementation of all ERP software modules

5. What was your role in this implementation?

6. Do you consider the implementation successful? Please explain how you define this answer.

7. How many ERPs has your company implemented?

8. Are there any major lessons you believe your company learned during the implementation?

<u>Company Productivity Measurements</u>

9. What are the key performance measures for your company?

10. Do you have a historical record of these measurements?

ERP Implementation Effect s on Productivity

11. Did Productivity change during the ramp up for ERP implementation? (between initiation of project until day before "go-live") If yes, how?

12. After switching to ERP, a decline in organizations performance was (select one):

- ❑ Not noticed
- ❑ Experienced over a short period of time
- ❑ Experienced over a long period of time
- ❑ Experienced and the performance level prior to ERP adoption was not recovered.

13. The following model shows a productivity of a typical company. Please indicate how the model would appear for your organization and indicate a date below each stage. Stages are defined as:

Design: Make decisions regarding process change and process integration

Implementation: Go Live with new system and business processes

Stabilization: Clean up processes and attempt to adjust to the new environment. Provide additional training to users and working with vendors to resolve bugs.

Continuous: Add functionality through bolt-ons. Engage in process redesign to implement new structures and roles to leverage the system.

Transformation: Changing organizational boundaries. Leverage organizational visibility to gain increased agility.

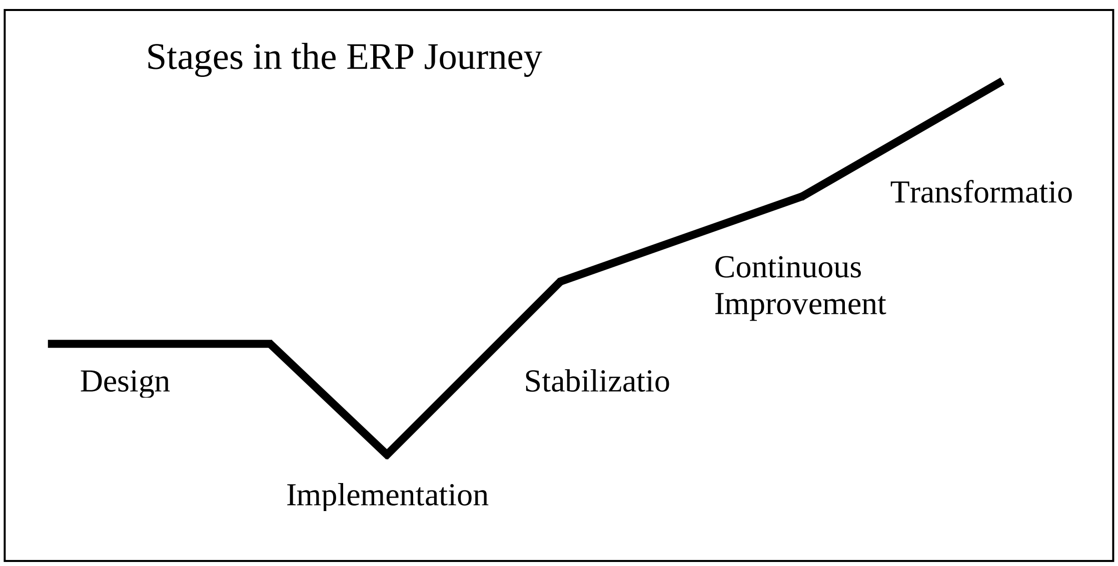

Figure 1, Stages in the ERP Journey Ross & Vitale, (2000)

Human Capital Factors

14. What did your organization do to minimize the depth and duration of the productivity dip during implementation?

Implementation Team Composition

15. Who was on the implementation team (experience level, functional areas represented, etc…)?

16. How did team member composition effect productivity during the implementation process?

Training

17. What type of training was accomplished in preparation for the implementation (hands-on training of new system, new business processes, etc…)?

18. Do you believe training affected the level of productivity during implementation? Please explain.

Empowerment

19. Was the implementation team empowered to make decisions relating to the project?

20. Do you believe empowerment led to increased productivity during implementation?

Expectations

21. Were the expectations for the project clearly communicated throughout the implementation projects span?

22. Do you believe expectations played a role in productivity during implementation? If so, why?

Recognition

23. Was there any type of recognition for personnel who were part of the ERP implementation

24. Do you think recognition effected productivity during the ERP implementation?

Manning

25. Did team members involved in the implementation spend full-time with the ERP project?

26. Were additional personnel hired, permanent or temporary, during the implementation?

27. Did the manning methods used by your organization play a role in productivity during implementation? Did you have to make any course corrections?

Communication

28. How would you describe the communications between stakeholders during the implementation?

29. Was the project's progress communicated as the implementation took place?

30. What role did communication play in the productivity during implementation and how did you influence it?

Social Factors

31. Did social factors have any role in the success/failure of the implementation (peer pressure, etc…)?

32. How did they affect productivity and how did you manage them during the implementation?

Workarounds

33. Did employees use workarounds following implementation?

34. Did workarounds result in any loss to productivity during implementation and how did you address them?

Resistance

35. Did you witness any resistance to implementation? If so, please describe what you experienced and how you resolved it.

36. What role did resistance play in the productivity level during implementation?

Turnover

37. Did any key personnel depart the organization during implementation? If so, how many?

38. What effect did turnover have on productivity during implementation and how did you control it?

Sabotage

39. Are you aware of any acts of sabotage? If so how did you address them?

40. How significant were acts of sabotage in regards to productivity during implementation?

Overall

41. How much of the organizations change in productivity do believe is attributed to the human capital factors we discussed above?

42. Below are the potential human capital factors we have discussed that could affect the success of an ERP implementation. Please mark how influential, in your opinion, these factors are to the overall success of an ERP implementation.

Potential Human Capital Factors	Very Negative Influence	Between ↔	Moderate Negative Influence	Between ↔	No Influence	Between ↔	Moderate Positive Influence	Between ↔	Very Positive Influence
Team Composition	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Training	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Empowerment	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Expectations	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Recognition	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Manning	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Communication	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Social Factors	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Workarounds	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Resistance	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Turnover	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Sabotage	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]

Wrap up

43. Can you point to one or two events that changed the course of this project?

44. Is there anything you wish to add or comment on that I failed to bring up?

User Interview Guide

Human Capital Influences on Productivity During ERP Implementation

User Interview Guide

ERP User Interview Questions

Background Information:

Name____
Job Title ______________________________Years with Company ___________
Company Name____
Industry____
Total # of: Company Employees _______

1. What was your job during the ERP implementation?

2. How often do you use the ERP system?

- What, if anything, does the new system do for you that the old system did not?
- What, if anything did the old system do for you that the new system can't

3. How did your job change after the ERP implementation?

4. Do you think the organization is better now you have the ERP system?

<u>Implementation Team Composition</u>

45. Were you a member of the implementation team?

46. If yes, how do you think the team contributed to productivity during implementation?

<u>Training</u>

47. Did you receive training on new business processes or the new system?

48. How did training affected the level of productivity during implementation? Please explain.

<u>Empowerment</u>

49. If you were on the implementation team, were you empowered to make project decisions?

50. How did empowerment lead to increased productivity during implementation?

Expectations

51. Were your expectations for the ERP system and implementation met?

52. What role did expectations play in productivity during implementation?

Recognition

53. Was there any type of recognition for personnel who were part of the ERP implementation?

54. How did recognition effect productivity during the ERP implementation?

Manning

55. Were team members involved in the implementation work on it as their full-time job?

56. Were additional personnel hired, permanent or temporary, during the implementation?

57. How did the manning methods used by your organization influence productivity during implementation?

Communication

58. How did you learn about ERP progress, issues and news in general?

59. What role did communication play in the productivity during implementation?

Social Factors

60. Did you feel any pressure from peers or management to reject the system or embrace the system?

61. How did this affect productivity?

Workarounds

62. Did you use workarounds following implementation?

63. If yes, why did you use workarounds?

Resistance

64. Did you witness any resistance to implementation? If so, please describe what you experienced and how it was resolved.

65. What role did resistance play in the productivity level during implementation?

Turnover

66. Do you know of any personnel who left the organization because of the implementation?

67. Were you ever tempted to leave the organization because of frustration with the implementation?

68. What effect did turnover have on productivity during implementation?

Sabotage

69. Are you aware of any acts of sabotage?

70. How significant were acts of sabotage in regards to productivity during implementation?

Wrap up

71. Can you point to one or two events that changed the course of this project?

72. Is there anything you wish to add or comment on that I failed to bring up?

Appendix D: Blue Dart

Maj Julie S. Newlin, Student, AFIT
julie.newlin@us.af.mil
Word Count: 701

The Air Force is investing a great deal of time and money in development of the Expeditionary Combat Support System (ECSS), an Enterprise Resource Planning (ERP) system. When implemented, ECSS will completely transform the way the logistics community does business. It will reduce 400 plus legacy systems to just one enterprise wide system, as well as touch every process we operate and make major changes to most of these processes (Dunn, 2007). With any process change as large as ECSS, there will be a dip in productivity during implementation.

In order to minimize the productivity dip, it is necessary to have a realistic expectation regarding depth and duration of the dip, and understand the factors that contribute to the dip including how to manage them. The literature identifies what typical productivity changes look like over the duration of an implementation, but does not specifically address the factors that contribute to the dip. The intent of this study is to identify human capital factors that affect the dip. Then, using a multiple case study methodology, the study empirically tests how well the identified factors compare to what companies who implemented ERP systems actually experienced. Finally, this study identifies how companies can address human capital factors to minimize the dip.

The researcher found that any company implementing a large scale process change such as an ERP, will experience a dip in productivity during implementation. The duration of the dip is difficult to articulate, but findings indicate that it will be at least 30

days long and can last for greater than three years. Depth is even more difficult to define, and the best this researcher could do was categorize it as average to significant. The depth is based on severity of impact on productivity, which again varies by company. An organization should strive to identify productivity measurements prior to implementation and track them before and after go-live so that they can truly articulate not only the productivity dip, but the gains they later receive from the new system. It should also be noted that benefits may not truly be realized for several years following implementation, so productivity should continue to be tracked even after regaining pre-implementation levels.

The dip is attributable to factors such as software fit, timing and various human capital factors. This study found that on average, approximately 50% of the productivity dip is a result of human capital factors. If it is a vanilla implementation using COTS software, the human capital percentage is likely higher than if it is highly customized because you are using industry best practices and proven software. All factors must be considered, but by addressing this one piece companies stand to substantially reduce the depth and duration of the dip.

In order for a company to address the human capital factors, it needs to understand the various components, as well as understand which factors have the biggest impact. The research identified nine factors to consider when developing a plan to address the human capital influence and thus mitigate the dip. At the top of the list is implementation team composition, followed by training, team empowerment and manning each of which are equally weighted.

A level down, coming from partially supported propositions are social factors, communication, recognition, expectations and workarounds. Social factors include everything from cultural differences for companies with operations overseas, to pressures among employees in the organization. Communication has a wide impact and can actually affect several of the other categories. Recognition and expectations involve taking care of the employees by identifying their contribution publically and ensuring people have a realistic idea of what to expect during and after implementation. Workarounds can have a very positive or negative impact on productivity, depending on the driver of the workaround and whether or not it is sanctioned by management.

The researcher believes that the USAF should accept that there will be a productivity dip, start tracking measures now and continue indefinitely. Additionally, those implementing the system should ensure senior management has a realistic expectation for productivity when go-live occurs. Finally, they should address the human capital factors found to affect productivity, starting with cross-functional implementation team composition and appropriate empowerment, along with in-the-classroom training and adequate manning.

Julie Newlin is a student at the Air Force Institute of Technology.

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Vita

Major Newlin graduated from Wright State University in Dayton, Ohio in 1995 with a Bachelor of Science degree in business. Nine months later she entered the Air force as an OTS graduate. In 1998 she graduated from Valdosta State University, Georgia, with a Master's of Public Administration.

Her first assignment was to the 347th Mission Support Squadron where she served as distance learning officer before moving over to the 347th Component Repair Squadron as section commander. In June 1998, she relocated to Spangdahlem Air Base, Germany where she served as the section commander for the 606 Air Control Squadron. While assigned, she deployed to Lecce, Italy in support of the Kosovo Campaign. She later moved to the 52nd Mission Support Squadron as Chief, Relocations and Employment.

In July 2001, Maj Newlin moved to Colorado where she served three years as an Assistant Professor of Aerospace Studies at ROTC detachment 105, University of Colorado. In October 2004, she relocated to the Pentagon where she held the position of Director for Executive Services in Air Force A1. Two years later, in August 2006, Major Newlin moved to Wright Patterson AFB as the Military Personnel Flight Commander for the 88th Mission Support Squadron. While assigned she deployed to Afghanistan as part of an embedded training team, working with the Afghan National Army Air Corps. In May 2008, she entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation, she will take command of the 9th Force Support Squadron, Beale AFB, CA.

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14. ABSTRACT
The Air Force is investing a great deal of time and money in development of the Expeditionary Combat Support System (ECSS), an Enterprise Resource Planning (ERP) system. When implemented, ECSS will completely transform the way the logistics community does business. It will reduce 400 plus legacy systems to just one enterprise wide system, as well as touch every process we operate and make major changes to most of these processes (Dunn, 2007). With any process change as large as ECSS, there will be a dip in productivity during implementation.

In order to minimize the productivity dip, it is necessary to have a realistic expectation regarding depth and duration of the dip, and understand the factors that contribute to the dip including how to manage them. The literature identifies what typical productivity changes look like over the duration of an implementation, but does not specifically address the factors that contribute to the dip. The intent of this study is to identify human capital factors that affect the dip. Then, using a multiple case study methodology, the study empirically tests how well the identified factors compare to what companies who implemented ERP systems actually experienced. Finally, this study identifies how companies can address human capital factors to minimize the dip.

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